

Auction Guarantees for Works of Art

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Abstract

This paper addresses the question of whether auction guarantees change the bidding environment and whether they cause a change in price once the value of an item is taken into account. We analyze both the cases of third-party guarantees and in-house guarantees. We use two datasets: one of Christie's and Sotheby's Contemporary and Impressionist Evening Sales from January 2010 to February 2012 and another larger dataset consisting of all items auctioned at Christie's from 2001 to May 2011. While more expensive items are more likely to have guarantees, we find little empirical evidence to suggest an effect on price from the guarantee itself once the value of the item is taken into account.

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1.0 Introduction

In May of 2015, Picasso's work, *Women of Algiers, Version O*, broke through previous auction records by fetching an astounding \$179 million at Christie's. While not widely noticed or reported, a price for this painting was guaranteed by a third party. The painting was sold before the auction began. According to a November 28th, 2013 article by Charlotte Burns as published in the *Art Newspaper*, "Guarantees are controversial as they potentially distort the market". The article proceeds to quote a New York collector: "...it can just inflate prices, and that can't go on forever". On May 5, 2014, the *New York Times* describes guarantees as "fueling a speculative fever".

The primary question that we seek to answer in this paper is whether auction guarantees change the bidding environment and whether they cause a change in price once the value of an item is taken into account. We analyze both the case of third-party guarantees and in-house guarantees. There have been many studies that theoretically analyze this issue in a similar, but not identical, context. We synthesize these studies to make predictions, and then we turn to the data. The datasets that we use are a unique dataset consisting of all items auctioned at Christie's from 2001 to May 2011 and a smaller dataset of Christie's and Sotheby's Contemporary and Impressionist Evening Sales from January 2010 to February 2012. We supplement the larger dataset with the smaller data set from both auction houses to compare the effects of the guarantor compensation rules at the two houses. We have final price, high and low price estimates, date, and the special notice, which indicates whether or not there was a guarantee and third-party participation. We test for whether or not items with a guarantee fetch a significantly different price, controlling for pre-sale estimate, than do other items. We have also identified a significant number of repeat sales, and we can test whether an item that has been sold with a guarantee differs significantly from an item that is sold without a guarantee.

This paper proceeds as follows. Section 2 describes the details of auction guarantees at the two most important auction houses. Section 3 describes the theoretical predictions. Section 4 describes the data and summary statistics, section 5 describes the empirical model and results, and section 6 interprets the results and concludes the analysis.

2.0 Background on Auctions, In-House Guarantees, and Third-Party Guarantees

Historically, the major auctioneers of art have been the English houses of Sotheby's and Christie's. Almost all art is auctioned in the "English" or "ascending price" format. Bidding

starts low, and the auctioneer subsequently calls out higher and higher prices. When the bidding stops, the item is said to be “knocked down” or “hammered down”, and the final price is the “hammer price.”

Not all items that have been put up for sale and “knocked down” have been sold. Sellers of individual items will set a secret reserve price, and if the bidding does not reach this level, the items will go unsold. It may be put up for sale at a later auction, sold privately, or taken off the market. It is often believed that when an item goes unsold, its value has been harmed. Beggs and Graddy (2008) show empirically that lower returns are correlated with items that have previously not met their reserve price.¹

Because of the fear of an item going unsold, the process of guaranteeing prices started. The first third-party guarantee, as reported by *The Economist*, took place at Sotheby's in 1999, and was a \$40 million guarantee for Picasso's "Seated Woman in a Garden". But guarantees can be expensive for the auction house. According to the *Art Newspaper* (March 2, 2011), the most disastrous guarantee occurred when the firm, Phillips, de Pury and Luxembourg, offered large guarantees to compete with Christie's and Sotheby's. In a November 7, 2001 sale of the collection of Nathan and Marion Smooke, Phillips guaranteed \$180 million worth of works, but only raised \$86 million. According to *The Economist* (2011), Christie's and Sotheby's were forced to pay out over \$200 million dollars in guarantees in the fall of 2008. Hence, third-party guarantees have become popular.

Christie's started using third-party guarantees in 2006, but did not distinguish third-party guarantees from in-house guarantees in the “special notice” section until 2010.² Sotheby's notes the presence of a third-party guarantor or the presence of an in-house guarantee with a symbol next to the lot, and distinguishes between in-house guarantees and outside guarantors. The form of the third-party guarantee has since developed differently at the two main auction houses. At Christie's, the third-party guarantor receives an agreed-upon share of the difference between the

¹ Hortsmann and LaCasse (1997) show theoretically that for some types of items, unsold items could also increase in price as only sellers with high value items would be willing to wait for a resale. However, that is not the popular belief in the art market nor is it supported by empirical evidence in the art market.

² This time period is consistent both with reporting by *The Art Newspaper* (January 13, 2010) and with our Christie's dataset.

hammer price and the guarantee price, even if he wins the auction. This payment is essentially a financing fee for agreeing to guarantee the item. This gives the guarantor an advantage in bidding for the item against another potential buyer. In contrast, at Sotheby's, the third-party guarantor cannot collect a financing fee from the seller if he wins the auction. Please see Table 1 for wording of special notices at Christie's.³

The auction houses only disclose the existence of a guarantee on an item. The catalogue does not indicate the amount of the guarantee or the identity of the guarantor. Just as the low estimate is at or above the seller's reserve, the low estimate will be at least as high as the guarantee (Melikian, 2013). The available information on auction results does not indicate whether an item sold at the guarantee price or at a higher price. We also cannot determine if the buyer was the guarantor (the auction house reveals neither identity).

3.0 Predictions

3.1 Outside Guarantee at Christie's

We start by analyzing the case of an outside guarantor at Christie's, when the guarantor still receives compensation even if he is the winning bidder. This case is similar to the case of a bidder in a corporate takeover who has an initial stake in the firm, known as a toehold, a stalking horse in a bankruptcy battle, or a buyer in an auction who receives a discount.⁴ The predictions

³ Lots with guarantees are noted by symbols at Sotheby's. The two relevant symbols are those for in-house guarantees and those for irrevocable bids:

“The seller of lots marked with an "O" has been guaranteed a minimum price from one auction or a series of auctions. If every lot in a catalogue is guaranteed, the Conditions of Sale will so state and this symbol "O" will not be used for each lot.”

“Lots with this symbol "D" indicate that a party has provided Sotheby's with an irrevocable bid on the lot that will be executed during the sale at a value that ensures the lot will sell. The irrevocable bidder, who may bid in excess of the irrevocable bid, will be compensated based on the final hammer price in the event he or she is not the successful bidder. If the irrevocable bidder is the successful bidder, they will be required to pay the full Buyer's Premium and will not be otherwise compensated. If the irrevocable bid is not secured until after the printing of the auction catalogue, a pre-lot announcement will be made indicating that there is an irrevocable bid on the lot. (Effective for sales commencing October 20, 2008)”

⁴ See Engelbrecht-Wiggans (1994), Burkhart (1995), Singh (1998), Klemperer (1998), Bulow, Huang, and Klemperer (1999), Li (2013), and McAfee and McMillan (1989) for bidding ring, toehold bankruptcy and buyer discount applications. Engelbrecht-Wiggans (1994), Burkhart (1995), and Singh (1998) focus on a private values model, whereas Klemperer (1998) and Bulow, Huang, and Klemperer (1999) focus on the common value scenario.

hinge upon whether bidders have primarily common values or private values. As most of the outside guarantors are well-known dealers, we believe that the common values case applies. The private values case is analyzed in an online appendix.

The common values case, where the bidders have identical, but unknown, valuations for an object (but have different signals of its actual worth) closely resembles Klemperer's (1998) "Wallet Game". Klemperer refers to the case as "almost" pure common values because one of the bidders receives a proportion of the winning bid. With pure common values, the two bidders value the item identically. The prediction in the (almost) pure common values case is that if all bidders identically valued the item (but the true value is unknown), the guarantor would always win at a price substantially below the price that would have occurred without the profit-sharing agreement. Of course, the guarantor does not always win, but Bulow, Huang, and Klemperer (1999) show the results extend qualitatively to the case when small private value components considered. Hence, with mostly common values, the effect of the guarantor being allowed to bid and share in the profits would be that the guarantor would win the auction a greater proportion of the time than other bidders, and at a lower price.

The intuition is as follows and relies on the well-known "winner's curse." In a common value auction, the winner has the potential to suffer from the "winner's curse": he has bid more than anyone else in the auction for an item that subsequently will have an identical value to all bidders. By winning, he is likely to have overvalued the item. This leads all bidders to bid less aggressively, i.e. shave their bids, than they would have if they had perfect information of the items worth. However, if a guarantor shares in part of the profits, he has an incentive to stay in the bidding longer and to push up the winning bid, because he receives a share of the difference between the winning bid and the guarantee price (another way to think of it is that it becomes "cheaper" for the guarantor to bid). This magnifies the winner's curse suffered by the other bidders, so the other bidders exit the auction even earlier than they would otherwise have without the advantaged bidder, resulting in a lower price, and the guarantor winning the auction.

There are several differences between the corporate takeover example and our price guarantees. First, the guarantee price is a breakpoint at which the toehold changes structure. Bids by others below the guarantee price have no effect on the price that the guarantor pays. The toehold only becomes effective above the guarantee price, but of course, other buyers do not know the guarantee price. Guarantors become advantaged bidders, but they must negotiate a

guarantee agreement (including a guarantee price) with the buyer. This negotiation process is discussed further below.

Second, unlike owners of toeholds, the identity of the guarantor is not known except to the seller and the auction house. The sale catalogue reveals whether an item has a guarantee, but bidders will not know whether they are competing against the guarantor or another independent bidder.

In the finance literature, there is evidence that a toehold may reduce the winning price (see Walking (1985), Betton and Eckbo (1995), and Bulow, Huang, and Klemperer (1999), among others, for more details). Thus, as we expect an art auction to more closely resemble the common values case, with an outside guarantee at Christie's where the guarantor can bid in the auction, we would predict a decline in price.

3.2 Outside Guarantees at Sotheby's

As we discussed above, Sotheby's guarantees do not allow the guarantor to receive compensation from the consignor when the guarantor bids to win the painting at a price greater than the guarantee price. Thus, once the auction price rises above the guarantee price, the guarantor has no advantage over other buyers—he cannot buy at a discount relative to them.

With private values, the only effect of the guarantee is that the guarantee price exceeds the seller's private reserve, which pushes up the minimum price at which a bidder can win the item. Above the guarantee price, the guarantor and other bidders are on an equal footing.

3.3 In-House Guarantees: Increase in Price

In-house guarantees were once more common than outside guarantees and, as noted above, are still very much in use. When the auction house is the guarantor, it cannot bid in the auction. Thus, the effect on price would be similar to that in the private values case without a toehold. The minimum price that a buyer will pay is higher since the guarantee price exceeds the seller's reserve price, but there is no effect on the hammer price conditional on reaching the guarantee price.

3.4 Further Considerations

In the analysis above, we considered the effect of a guarantee on price, but we do not model the decision to guarantee an item in the first place. Empirically, important and expensive items are the ones that are more likely to be guaranteed, either in-house or by a third-party. The guarantee decision itself can convey information that may increase price in a common value

environment, both for outside and in-house guarantees. The intuition is that the more information that bidders have on the actual value of an item, the less they are likely to shave their bid to avoid the winner's curse. The fact that an item is guaranteed provides more information on the item.

The level of the guarantee price is negotiated between the seller and the guarantor. In the online appendix, we use put-call parity (Brealey and Myers [1991, p. 488-490]), to show that the guarantee price is determined by the proposed split in gain between owner and guarantor.⁵

4.0 The Data and Summary Statistics

The data for this study were collected online. We collected data from Christie's sales from the beginning of 2001 through June of 2011, and a more restricted data sample from Christie's and Sotheby's sales from 2010 through February 2012.

In the large Christie's sample, we were specifically concerned with the sale notes. In total, the data contain 1,165 different types of footnotes that range from VAT notices to notices about free storage after the sale. We searched through these footnotes to identify the two different types of footnotes in which we are interested—those footnotes indicating either just a house guarantee or indicating the possible presence of an outside guarantor. As outside guarantees began at Christie's in 2006, which is confirmed in the data by the presence of footnotes indicating outside guarantors and *The Art Newspaper* (January 13, 2010), we only used data from 2001 to 2011, to give us 5 full years of sales with just in-house guarantees before the presence of outside guarantors.

Table 1 presents a quick snapshot of the full data set. Footnote 1 presents the typical wording for a Christie's-only guarantee. As is evident from the table, this wording was only used until 2006. From 2006 to 2010, Christies did not distinguish between in-house guarantees and outside guarantees, as is evident from the wording in footnote 2 and the observations in column 2. Only in 2010 did Christie's start distinguishing, in some cases, outside guarantees. The typical wording for an outside-only guarantee is given in footnote 3 of Table 1.

⁵ Greenleaf, Rao, and Sinha (1993) model a guarantee by the auction house as the outcome of a Nash bargaining process over the guarantee and the commission where the auction house resells the item if it is bought in. Third-party guarantors often retain the item for their own collections or inventories when the item does not sell.

Table 2 summarizes the guarantees by department (type of item or art category). For auctions that occurred before 2006, departments were not listed on the html pages that we were able to access. Hence, for 1,908 Christie's-only guarantees, we do not know the department. Columns 2 and 3 show the departments that had guarantees after 2006. Most of the guarantees occur in departments that sell art rather than other collectibles.⁶

While the department is not explicitly listed before 2006, we know the title of the sale (e.g. Post-War and Contemporary Art) for all items. We extract the keywords from the sale title, and in this way we identify auctions of art and restrict our sample to works of art. The sample used in our primary regressions consists of all items that have the keywords "Contemporary", "Impressionist", "print", "master", "painting", "art", or "Brody" in the sale title.⁷

In addition to this dataset, we also construct a repeat sales dataset as follows. First from the Christie's dataset, we pulled out all lots that had one of the three types of guarantees as noted in Table 1. We then went back to the auction with the guarantee and used the provenance – the record of ownership of a work of art that is published in the auction catalogue – to look for previous sales of the guaranteed work. If a previous sale was found for a guaranteed work in a particular auction, then we proceeded to look for previous sales for all works in that particular auction. In this way, we were able to reduce the effort required to assemble a repeat sales dataset and create a more homogeneous sample.

Because Christie's had only started to note those items with outside guarantors towards the end of our sample, we collected further data from both Christie's and Sotheby's during the period 2010 through February of 2012. We restricted our data collection to Contemporary and Post-War Evening Auctions, and to Impressionist and Modern Art Evening Sales, as these are the sales most likely to have outside guarantors. Table 3 shows that there are approximately equal numbers of observations (775 at Christie's and 796 at Sotheby's), and approximately equal

⁶ Appendix Table 1 shows the currencies in which the original sale was recorded, and thus demonstrates the locations where guarantees are more common. As is evident, most guarantees took place in the U.S., the U.K., or Europe, which were the major markets for high-end art at the time.

⁷ The keyword "Brody" is included because, of the 26 items that indicated outside guarantees only, 5 items (or 20%) were included in the sale titled "Property from the Collection of Mrs. Sidney F. Brody".

numbers of sales notes indicating outside guarantors at the two auction houses (47 at Christies and 38 at Sotheby's). Most guarantees were at auctions that took place in the US.

Before presenting regression results, it is useful to examine some summary statistics on guaranteed versus non-guaranteed items. Figure 1 presents histograms of the ratio of hammer prices to low estimates for the Christie's/Sotheby's sample. At both houses, the price-low estimate ratio for guaranteed items is almost bounded from below at 1, with a large fraction of sales at that ratio. In contrast, non-guaranteed items have a more diffuse distribution, with price-low estimate ratios further below 1 and generally a more diffuse distribution. This pattern is consistent with the hammer price equaling the guarantee price for some proportion of guaranteed items. In the larger Christie's dataset (histogram not shown), the lower bound at 1 only appears for items with third-party guarantees and not for the other forms of guarantees. For in-house guarantees, some items may sell below the guarantee price with the auction house compensating the buyer after the sale for the difference, which accounts for the greater diffuseness in the ratios for Christie's-guaranteed items.

5.0 Econometric Model and Results

Testing for price differences is difficult because each work of art is unique. More expensive works of art are more likely to be guaranteed, and hence sample selection is a real concern. Even using repeat sales of the same item, tastes for different artists and different types of works can change between sales. Artists can become "hot" or "cold."⁸

Our main way to control for uniqueness of each item is therefore to control for the pre-sale estimate. The primary econometric model that we use for testing price differences is to regress the log of the price on the log of the low and high estimate and on a dummy variable for the type of guarantee. Rather than placing a restriction on the relative importance of the low and high estimate, we include both together in our primary regression.⁹ We include auction-specific

⁸ This sample selection could be taken into account by a two-stage sample selection model, identified ideally by an instrument that is correlated with the decision to guarantee an item but excluded from the pricing equation. However, auction houses do not usually reveal the identity of the sellers, and even if they did, it is doubtful that such an instrument exists. Any item characteristics that we used for identification would rely on strong distributional assumptions.

⁹ While there is clearly co-linearity between the low and high estimates, our purpose is to control for the estimate of the hammer price as well as possible, rather than placing a restriction on the functional relationship between the estimates.

fixed effects to further control for the heterogeneity of different items in different auctions.¹⁰ Thus, our basic specification is:

$$\ln(P) = \alpha + \beta_1 \ln(LE) + \beta_2 \ln(HE) + \gamma_1 G_1 + \gamma_2 G_2 + \gamma_3 G_3 + \sum_{n=1}^{N-1} \delta_n A_n + \varepsilon_i$$

In the above equation, P is the price at which an item sells (including commission), LE is the low estimate, HE is the high estimate, G_1 is a dummy variable equal to 1 if the item has an in-house guarantee only, G_2 is a dummy variable equal to 1 if the sales not does not distinguish between an in-house or outside guarantee, and G_3 is a dummy variable equal to 1 if the sales note indicates an outside guarantee. The A_n variables are auction-specific fixed effects, and ε_i is the error term.

The common values model predicts that the toehold for outside guarantees at Christie's should have a negative impact on prices, and in particular relative to the outside guarantees at Sotheby's. Our first regressions focus on the sample of Christie's and Sotheby's Impressionist and Modern auctions during a period with a high incidence of outside guarantees.

In the regressions in Table 4, we identified only one type of guarantee, an outside guarantee. The first three columns indicate that guaranteed works sell for considerably higher prices, but these works also have commensurately higher low and high estimates. This positive relationship between guarantees and estimates is consistent with the belief among art market participants that guarantees are more common among the highest-priced works. In Column 4, we control for the low and high estimates. Now, the guarantee has little effect on price, and it is not statistically significant.¹¹

Because of the difference in compensation for guarantors who win the auction at Christie's and Sotheby's, it is important to see if the guarantee effect differs between auction houses. When the Christie's and Sotheby's guarantees are tested separately (columns 5 to 8), the point estimates of the effects of the magnitude of the guarantees are nearly identical, despite the toehold at Christie's and the absence of any toehold at Sotheby's. This applies to testing for effects on prices, estimates, and on prices controlling for estimates. The Christie's point

¹⁰ At times, two or more auctions can be held on the same date. In particular, items in afternoon and evening sales have different ranges of estimates. Hence, auction-specific fixed effects are tighter controls than date fixed effects.

¹¹ We obtain similar results if we use only the low or high estimate in the regression.

estimates are actually larger than the Sotheby's point estimates, although the difference is not statistically significant.

In columns 1 through 4 of Table 5 we present the results for the longer Christie's sample of Evening and Important Sales of Contemporary and Impressionist Art, where guarantees were more common than in other art sales. In this data set, we have three types of guarantees, in-house, outside, and unspecified, and we can look for difference in the effects of different types of guarantees.

As in the shorter Christie's/Sotheby's sample, we first regress log price on the guarantee dummies without controlling for the estimates. We do the same for the log of the high estimate (HE) and for the log of the low estimate (LE). From these regressions it is clear that items with all types of guarantees tend to be more valuable than other items, and this especially holds true with an outside guarantee. Notice that, even after controlling for average price in a particular auction through fixed effects, those items with outside guarantees have prices and estimates that are about 1.5 times as great as the average auction item. This is even larger in magnitude than in the smaller Christie's/Sotheby's sample. The effect of the guarantees on the high estimate and the low estimate appears to be nearly identical. Column 4 estimates the effects of guarantees, controlling for high and low estimates. Now, the coefficients on the dummies for all three types of guarantees are negative, but not significant except the in-house or outside guarantee effect is marginally significant. Appendix Table 2 presents results for all art categories at Christie's. Controlling for estimates, all guarantee dummy coefficients are negative and significant, with the price effects ranging from 5% to 15% in magnitude. The fraction of guarantees is much smaller in the expanded sample, so selection bias might be more of a concern.¹²

Our findings are consistent in direction with our findings in the previous sample, though in this sample all statistically significant effects (at the 5% level) disappear when we control for the estimates. Our interpretation of the above regressions is that the guarantees are not having an

¹² In Appendix Table 3, we present the regressions using the entire sample of over 1.3 million lots. When the low and high estimates are controlled for in the regressions, the coefficients on guarantees are relatively small (-.08 on the in house guarantee and .06 on the in house or outside guarantee), but they are statistically significant and in opposite direction. On the outside guarantee only, the coefficient is -.10, but is not statistically significant at the 5% level – only at the 10% level. We believe this difference is coming from the heterogeneity in the sample – the items being auctioned are vastly different.

effect on price once the value of the item is taken into account and once we adjust for heterogeneity of the items being auctioned by homogenizing the sample.

In order to further homogenize our sample, we assembled a sample of repeat sales. For all sales in which at least one item was sold subject to any of the three types of guarantees, we searched for previous auction sales for every item in that sale using the Blouin Art Sales Index (a database of auction sales back to 1922). This yielded a sample of 784 pairs of sales (each pair is an observation) in which the second sale might have had a guarantee. The dates of previous sales range from 1962 to 2010. Using the items without a guarantee from the sales with some guaranteed items as controls restricts us to similar categories of painting since auction houses assemble sales of similar items (such as Impressionist or Contemporary Art, with a further division into afternoon and evening sales with more valuable works in the evening sales).

In Table 6, we present a standard repeat sales regression with the Case-Shiller (1987) correction for heteroskedasticity with two additional dummy variables for a Christie's only guarantee or a Christie's or outside guarantee.¹³ In Column 1, we regress the price change on the dummies and the year-by-year return fixed effects. In Columns 3 and 4, we regress the change in the low or high estimate on the same right-hand side variables (estimates for the prior sale are only available for later dates, so it is a smaller sample). In Column 2, we repeat the regression on the price change with the smaller sample for comparability. The results are even stronger than before, most likely because the repeat sales technique is a much better control. The Christie's or outside guarantee has a large positive effect on the price change or on the change in low estimates, and the magnitudes are quite similar in all four regressions. The fact that the outside guarantee is so strongly correlated with return is not surprising. Those works that have increased most in value are more likely to attract outside guarantors. In contrast, the Christie's in-house guarantee has a smaller, negative effect which is not statistically significant. Finally, in column 4, once we control for the changes in the low estimates and the high estimates for repeat sales, we again find no effect of the guarantee on price.¹⁴

¹³ There were only two observations with an outside only guarantee in this data set, so we combined these observations with ones with a Christie's or an outside guarantee.

¹⁴ The coefficients on the low and high estimate in Column 5 of Table 5 sum to 0.76; in Columns 4 and 8 of Table 4, the estimate coefficients sum to 0.99 and 0.91. If we model the change in the estimate and the change in the hammer price between the two sales as equal to the change in

6.0 Interpretation and Conclusion

These results indicate that for sales of Contemporary and Impressionist Art – the types of art that consistently make headlines – the guarantee itself has no effect on the final price achieved, once the value of the item is taken into account. More valuable items are more likely to be guaranteed, which is consistent with the auction houses using guarantees in order to attract commissions. This is especially the case for outside guarantees.

We do not believe that the auction houses consciously and systematically change the estimates for guaranteed items because of the way in which estimates are given. Even if this were the case it is unclear whether the estimates would be higher or lower and the primary concern would be co-linearity. The size of the coefficients on the guarantees are in all cases small for our Impressionist and Modern art sample (less than 5%) and in different samples that we tried are sometimes positive and sometimes negative. Thus, there is little to no economic effect of the guarantee on price, once the value of an item, as measured by the pre-sale estimate, is taken into account.¹⁵

For outside guarantees, we find little support for the toehold effect, despite our expectation that values are affiliated (by having at least some common value element). The most surprising part of this is that we find no appreciable difference between Christie's and Sotheby's for outside guarantees, contrary to a prediction of a more negative effect at Christie's. We speculate that a guarantee from an outsider may give a strong signal of the market for a painting and eliminate any effect of bidding against an advantaged bidder. Items that are guaranteed are likely to be more valuable than those items without a guarantee, and this heterogeneity offsets any strategic effect that could be occurring by the guarantee.

The art community has been critical of allowing bidding by outside guarantors, particularly in the toehold case as at Christie's. Theory suggests that toeholds discourage outside

a signal of the expected price (plus different error term for the estimate and hammer price), then the coefficient on the estimate change is biased downward from one. This is a conventional errors-in-variables issue.

¹⁵ Mei and Moses (2005) find that estimates have an upward bias for expensive items, and a downward bias for less expensive items. As guaranteed items generally are more expensive items, this bias, if actually present, could potentially affect the error estimates, but not the size of the coefficients.

bidders and can lead to lower prices. We conjecture that a policy change at Christie's imposing a "no-toehold rule" would avert a potential to lower prices, while it would raise confidence of participants in the fairness of the auction mechanism. The policy would also make transaction prices more transparent, since the guarantor-buyer would not be buying at a discount relative to the announced hammer price.

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“For Online Publication”

Online Appendix: The Private Values Case with a Toehold

From the perspective of the buyers, third-party guarantees have many similarities to a seller’s secret reserve price. In both cases, bidders may need not only to outbid other active bidders on the floor, but the seller or the guarantor. To explore these issues, it is worthwhile to model a standard environment used in the theoretical analysis of auctions—the independent private values model. Potential buyers have valuations for the item that do not depend on others’ valuations, and the distributions of these values are independent.¹⁶

This Appendix considers this model in some detail. We establish that a seller requires the guarantee price to exceed the (private) reserve price, since the seller gives up the item to the guarantor in the event the hammer price is below the guarantee price. If the guarantor cannot bid in the auction, the guarantee thus increases the minimum price paid by another bidder.

When the guarantor can bid (as at Christie’s and Sotheby’s), the guarantor is willing to bid up to her own valuation for the object. A guarantor in a Christie’s auction who is risk-neutral would be willing to bid beyond that level. Other bidders will be unaffected by the fact that the guarantor will share in the profits, and will not change their bidding strategies. Thus, the expected final price is higher than in the absence of a guarantee, but only because the minimum price at which an outsider wins the item is higher.

We drop a common assumption in the private values model—that of identically distributed values. The guarantor plays a key role in these auctions, and thus, it seems important to allow for her value to be drawn from a different distribution.

Let v_0 denote the seller’s valuation of the item. Let the guarantor’s valuation be drawn from a distribution $F_G(v)$, and let v_G denote the guarantor’s value. The other potential buyers have values drawn from a distribution $F(v)$. Let v_1 and v_2 denote the highest and second-highest valuations of potential buyers other than the guarantor.

From Riley and Samuelson (1981), the optimal reserve price for the seller equals:

$$v_* = v_0 + \frac{1 - F(v_*)}{f(v_*)}$$

¹⁶ The private values case of toeholds has been analyzed in Engelbrecht-Wiggans (1994), Burkhart (1995), and Singh (1998).

if all potential buyers' valuations are drawn from the same distribution. A guarantor therefore would set a reserve price of $\hat{v} = v_G + \frac{1 - F(\hat{v})}{f(\hat{v})}$ if she first purchased the item from the original seller. Notice that, using Myerson's (1981) virtual price formula, the owner's value is the virtual price for the reserve price.

Suppose that the guarantor offers the seller a price p_G and retains all profit from the auction with n bidders. Then her expected profit equals:

$$v_G [F(p_G)]^n + \text{Expected Revenue} - p_G$$

where $\text{Expected Revenue} = n \int_{p_G}^{\bar{v}} (vF'(v) + F(v) - 1)F(v)^{n-1} dv$. The optimal reserve price for a seller with valuation equal to v_G is the solution to the problem:

$$\text{Max}_{v_*} v_G [F(v_*)]^n + n \int_{v_*}^{\bar{v}} (vF'(v) + F(v) - 1)F(v)^{n-1} dv.$$

A guarantor choosing a guarantee price would be maximizing:

$$v_G [F(p_G)]^n + n \int_{p_G}^{\bar{v}} (vF'(v) + F(v) - 1)F(v)^{n-1} dv - p_G.$$

Thus, we see that $p_G(v_G) < v_*(v_G)$ (the two functions differ by the term $(-p_G)$ and thus the derivative with respect to p_G is smaller than the derivative with respect to v_*). The guarantor cannot freely set the guarantee price because she must negotiate with the consignor, but she prefers a lower guarantee price than the reserve price conditional on her private valuation (which will be unknown to the consignor). It is obvious that the guarantee price must exceed the seller's reserve price since the seller gives up the item when accepting a third-party guarantee.

One should note that a certain "pyramiding" occurs. The private reserve is a markup above the seller's reservation price, and the guarantee price will exceed that. Thus, the minimum price at which a sale occurs is pushed up by a guarantee. Were the guarantor unable to bid in the auction, he would prefer to be able to set a reserve price greater than both his valuation and his guarantee to the seller.

If the guarantor shares the auction profit exceeding the guarantee (ignoring commissions) with the consignor, her profit (with a 50-50 split, the most common arrangement) equals:

$$(v_G - p_G) [F(p_G)]^n + \frac{1}{2} \left(n \int_{p_G}^{\bar{v}} (vF'(v) + F(v) - 1)F(v)^{n-1} - p_G \right) dv.$$

It may be useful to write this slightly differently as:

$$v_G [F(p_G)]^n + \frac{1}{2} \left(n \int_{p_G}^{\bar{v}} (vF'(v) + F(v) - 1) F(v)^{n-1} dv - p_G \left(1 - \frac{1 - [F(p_G)]^n}{2} \right) \right).$$

What happens when the guarantor can bid in the auction? We distinguish two scenarios—bidding below the guarantee price and bidding above the guarantee price. In the former case, suppose all but one bidder has dropped out. If the guarantor cannot bid, the auction will end with a hammer price below the guarantee, even though the high bidder is willing to pay more than the guarantee price. This is analogous to the case where the auction house bids at prices below the reserve price. Bidding by the guarantor in this range doesn't raise the hammer price beyond the level it would reach if the guarantor were in the auction as an ordinary bidder (since his guarantee price is less than his value).

Above the guarantee price, what is the effect of letting the guarantor bid? Note that the guarantor might have been one of the bidders absent his role as guarantor. What is the guarantor's profit function (with a payment of 50% of the excess of the hammer price over the guarantee) when he can bid? This equals:

$$(v_G - p_G)(p_G)^n + E \left(\frac{1}{2} [p - p_G] \mid p > p_G \right) \\ + E(v_G - p \mid p > p_G) \Pr(\text{guarantor wins above } p_G)$$

Clearly, the guarantor is willing to bid up to v_G . Indeed, a risk-neutral guarantor is willing to bid higher (analogous to a seller setting a reserve above his own reservation value).

A guarantor who can't bid in the auction earns a profit if the painting sells for more than P_G , but the hammer price might be less than v_G . In this case, the hammer price will be the greater of v_2 and P_G . The guarantor's profit when she does not win the item equals

$$\frac{1}{2} \max\{v_2 - P_G, 0\}. \text{ If the guarantor instead entered as a bidder, she would earn a profit of } \\ v_G - v_1.$$

The Private Values Model without a Toehold

Under the Sotheby's rules, if the guarantor bids and wins the item at a price in excess of the guarantee price, the guarantor does not receive any compensation from the consignor. Thus, the guarantor's profit function equals:

$$(v_G - p_G)(p_G)^n + E\left(\frac{1}{2}[p - p_G] \mid p > p_G\right) \Pr(\text{guarantor doesn't win above } p_G) \\ + E(v_G - p \mid p > p_G) \Pr(\text{guarantor wins above } p_G)$$

which is less than in the toehold case. Clearly, the guarantor is willing to bid up to v_G . Indeed, a risk-neutral guarantor is willing to bid higher (analogous to a seller setting a reserve above his own reservation value). But the lack of a toehold lowers the maximum bid that a guarantor is willing to make.

Since bidding above the guarantee price is the only range in which the Christie's and Sotheby's rules differ, the rest of the analysis of the private values case does not change.

Online Appendix: Determining the Guarantee Price with Put-Call Parity

The primary role of the guarantee is to offer some insurance to the seller. The seller is passing the risk of the item not selling to the guarantor (and thus obtaining a lower expected price at a future sale) in return for sharing a percentage of the gain when it sells for more than the guarantee. This percentage of the gain is the risk premium paid by the seller to the guarantor. The evidence on who makes third-party guarantees is consistent with guarantors being less risk averse than sellers. In such a case, both the seller and the guarantor gain.

One can describe the guarantee with gain-sharing as a combination of a put option (the seller gets at least the guarantee price) and a call option shared by the seller and the guarantor (for a 50-50 split of the excess of the hammer price over the guarantee, they each hold half the call). Using put-call parity as is well-documented in the financial literature (Brealey and Myers [1991, p. 488-490]), we can write the values of the options as:

$$P + S = C + G$$

where P is the price of the put, S is the anticipated auction price (analogous to the current price of the stock), C is the price of the call, and G is the amount of the guarantee (analogous to the present value of the exercise price).¹⁷ If the seller receives α of the excess over the guarantee (thus, α of the call) and the guarantor receives no other payment from the seller, $P = \alpha C$. Using this, the parity relationship becomes $S - G = (1 - \alpha)C > 0$. There is also a link between the

¹⁷ We ignore any discounting between the time of the guarantee being agreed upon and the time of the auction. To our knowledge, the guarantee is not paid until the auction.

guarantee price and the value of the stand-alone call, conditional on the distribution of the sale price. The split between the owner and the guarantor thus ties down the guarantee price.

Table 1: Year
 *Sales from Jan. 2001-June 2011

year	(1) Christie's Guarantee ¹	(2) Christie's or Outside Guarantee ²	(3) Outside Guarantee ³	(4) Total Lots
2001	568	0	0	161,445
2002	286	0	0	124,831
2003	95	0	0	125,811
2004	163	0	0	144,434
2005	792	0	0	158,321
2006	39	286	0	154,281
2007	0	778	0	132,913
2008	0	507	0	99,406
2009	0	35	0	82,019
2010	0	112	14	87,610
2011 (part)	0	10	12	48,738
2001-2011	1943	1728	26	1,319,809

¹On occasion, Christie's has a direct financial interest in lots consigned for sale. This interest may include guaranteeing a minimum price to the consignor of property or making an advance to the consignor which is secured solely by consigned property. Such property is offered subject to a reserve. This is such a lot.

²On occasion, Christie's has a direct financial interest in lots consigned for sale which may include guaranteeing a minimum price or making an advance to the consignor that is secured solely by consigned property. This is such a lot. This indicates both in cases where Christie's holds the financial interest on its own, and in cases where Christie's has financed all or a part of such interest through a third party. Such third parties generally benefit financially if a guaranteed lot is sold successfully and may incur a loss if the sale is not successful.

³On occasion, Christie's has a direct financial interest in lots consigned for sale, which may include guaranteeing a minimum price or making an advance to the consignor that is secured solely by consigned property. Christie's may choose to assume this financial risk on its own or may contract with a third party for such third party to assume all or part of this financial risk. When a third party agrees to finance all or part of Christie's interest in a lot, it takes on all or part of the risk of the lot not being sold, and will be remunerated in exchange for accepting this risk. The third party may also bid for the lot. Where it does so, and is the successful bidder, the remuneration may be netted against the final purchase price. If the lot is not sold, the third party may incur a loss. Christie's guarantee of a minimum price for this lot has been fully financed through third parties.

Table 2: Departments
 *Sales from Jan. 2001-June 2011

	(1) Christie's Guarantee ^a	(2) Christie's or Outside Guarantee	(3) Outside Guarantee	(4) Total Lots
Unknown	1,908	0	0	724,084
19th & 20th Century Posters	0	0	0	3,872
19th Century European Art	0	2	0	9,238
19th Century Furniture & Sculpture	0	0	0	4,938
20th Century British Art	0	12	0	22,715
20th Century Decorative Art & Design	0	76	0	14,331
African & Oceanic Art	0	0	0	2,237
American Art	26	102	0	3,150
American Folk Art	0	1	0	481
American Furniture & Decorative Arts	0	0	0	2,269
American Indian Art	0	0	0	665
Antiquities	0	0	0	4,852
Arms & Armour	0	0	0	2,467
Asian Contemporary & 20th Century Chinese Art	0	5	0	2,259
Australian Art	0	0	0	372
Books & Manuscripts	0	0	0	21,623
British & Continental Watercolors & Drawings	0	0	0	849
British & Irish Art	0	14	0	14,210
British Art on Paper	0	0	0	444
Cameras & Optical Toys	0	0	0	2,455
Chinese Ceramics & Works of Art	0	2	0	16,218
Chinese Classical & Modern Paintings	0	0	0	2,069
Clocks, Marine Chronometers & Barometers	0	0	0	2,294
Contemporary Art	0	212	0	4,639
Costume, Textiles & Fans	0	0	0	4,397
Dolls & Toys	0	0	0	2,723
European Ceramics & Glass	0	3	0	10,135
European Furniture, Decorative Objects & Early Sculpture	0	352	0	79,101
Exploration and Travel Art	0	0	0	609
German & Austrian Art	0	0	0	22
Icons	0	0	0	806
Impressionist & Modern Art	3	271	11	15,772
Indian & Southeast Asian Art	0	0	0	11,637
Interiors	0	228	0	64,435
Islamic Art	0	0	0	4,962
Japanese Art	0	1	0	6,922
Jewelry	0	66	0	36,000
Korean Art	0	0	0	86
Latin American Art	0	9	0	2,906
Maritime Collectibles	0	0	0	375
Maritime Pictures	0	0	0	3,701
Mechanical Music	0	0	0	456
Modern & Contemporary Arab & Iranian Art	0	0	0	566
Modern & Contemporary Indian Art	0	1	0	774
Motor Cars	0	0	0	639
Musical Instruments	0	0	0	2,016
Nordic Art	0	0	0	60
Old Master and 19th Century Art	0	2	0	13,256
Old Master Drawings	0	0	0	2,018
Orientalist Art	0	0	0	397
Photographs	0	0	0	7,111
Popular Culture & Entertainment	0	0	0	7,670
Portrait Miniatures	0	0	0	1,348
Post-War & Contemporary Art	7	169	14	13,114
Prints	0	149	0	16,605
Private Collections & Country House Sales	0	0	0	8,674
Rugs & Carpets	0	6	0	2,627
Russian Pictures	0	0	0	3,479
Russian Works of Art & Faberge	0	0	0	1,466
Silver & Objects of Vertu	0	14	0	11,582
South African Art	0	0	0	68
Southeast Asian Modern & Contemporary Art	0	0	0	1,469
Spanish Art	0	0	0	63
Sporting Art	0	0	0	817
Sporting Guns	0	0	0	322
Sports Memorabilia	0	0	0	1,543
Swiss Art	0	0	0	1,027
Teddy Bears	0	0	0	624
Travel, Science & Natural History	0	0	0	1,950
Victorian & British Impressionist Pictures	0	1	1	1,667
Watches & Wristwatches	0	13	0	11,827
Wine	0	18	0	102,338

^aPrior to 2006, departments were not generally listed on the webpage that was accessed.

Table 3: Summary Statistics for Contemporary
and Impressionist Evening Auctions, 2010-February 2012

	Outside Guarantee	Total Observations
Christie's	47	775
Sotheby's	38	796
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2010	22	491
2011	54	812
2012	9	268
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US	77	1294
UK	8	168
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Total	85	1,571

Table 4: Impressionist and Modern Art Auctions at Christies and Sotheby's
January 2010-February 2012

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	In P	In LE	In HE	In P	In P	In LE	In HE	In P
Guarantee	1.094*** (0.124)	1.186*** (0.120)	1.191*** (0.120)	0.038 (0.038)				
Christie's Guarantee					1.154*** (0.154)	1.246*** (0.151)	1.245*** (0.151)	0.047 (0.045)
Sotheby's Guarantee					1.022*** (0.199)	1.114*** (0.190)	1.125*** (0.191)	0.028 (0.061)
LE (Low Estimate)				0.545*** (0.137)				0.544*** (0.137)
HE (High Estimate)				0.344** (0.138)				0.345** (0.138)
Sale Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Constant	14.123*** 0.025	13.722*** 0.027	14.077*** 0.027	1.805*** 0.165	14.123*** 0.025	13.721*** 0.027	14.078*** 0.027	1.805*** 0.165
Observations	1,571	1,571	1,571	1,571	1,571	1,571	1,571	1,571
R-squared	0.265	0.234	0.237	0.889	0.265	0.235	0.237	0.889

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Art Auctions at Christies

	Evening and Important Sales of Contemporary and Impressionist Art			
	(1) ln P	(2) ln LE	(3) ln HE	(4) ln P
Christie's Guarantee	0.373*** (0.088)	0.446*** (0.091)	0.430*** (0.091)	-0.026 (0.027)
Christie's or Outside Guarantee	0.426*** (0.080)	0.525*** (0.081)	0.516*** (0.081)	-0.048* (0.028)
Outside Guarantee	1.463*** (0.254)	1.636*** (0.231)	1.634*** (0.232)	-0.024 (0.068)
LE (Low Estimate)				0.493*** 0.080
HE (High Estimate)				0.416*** 0.080
constant	13.785*** (0.017)	13.328*** (0.017)	13.677*** (0.017)	1.519*** (0.096)
Sale Fixed Effects	yes	yes	yes	yes
Observations	3,945	3,945	3,945	3,945
R-squared	0.319	0.332	0.333	0.898

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Repeat Sales Auctions at Christies

	(1) ln (Sale Price) - ln (Purchase Price)	(2) ln (Sale Price) - ln (Purchase Price) [Restricted Sample]	(3) ln (Low Estimate (Sale)) - ln (Low Estimate (Purchase))	(4) ln (High Estimate (Sale)) - ln (High Estimate (Purchase))	(5) ln (Sale Price) - ln (Purchase Price)
Christie's Guarantee	-0.039 (0.188)	-0.138 (0.224)	-0.138 (0.245)	-0.136 (0.247)	-0.030 (0.150)
Christie's or Outside Guarantee ^t	0.512*** (0.120)	0.373*** (0.139)	0.455*** (0.152)	0.463*** (0.153)	0.019 (0.093)
ln (Low Estimate (Sale)) - ln (Low Estimate (Purchase))					0.482*** (0.093)
ln (High Estimate (Sale)) - ln (High Estimate (Purchase))					0.278*** (0.089)
Year Fixed Effects	yes	yes	yes	yes	yes
Observations	784	400	400	400	400
Root MSE	1.030	1.0204	1.025	1.0648	1.029

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

^tThe category from Table 1, "Outside Guarantee", only has two observations in this sample. Therefore, we merged this category with the category, "Christie's or Outside Guarantee."

Appendix Table 1: Currencies (indicating location)

*Sales from Jan. 2001-June 2011

Currency	(1) Christie's Guarantee	(2) Christie's or Outside Guarantee	(3) Outside Guarantee	(4) Total Lots	(5) Currency Description
\$	1,229	913	20	341,159	US Dollar
A\$	0	0	0	12,251	Australian Dollar
CHF	113	9	0	31,743	Swiss France
DM	0	0	0	553	Deutsch Mark
F	23	0	0	6957	French Franc
HK\$	0	12	0	36,433	Hong Kong Dollar
Lit	0	0	0	5,533	Italian Lira
NT\$	0	0	0	117	New Taiwan Dollar
S\$	0	0	0	1,541	Singapore Dollar
€	38	322	0	213,485	Euro
£	540	455	4	657,789	British Pound
Total	1,943	1,711	24	1,307,561	

Appendix Table 2: Art Auctions at Christies

	All Art			
	(1) ln P	(2) ln LE	(3) ln HE	(4) ln P
Christie's Guarantee	0.209*** (0.049)	0.265*** (0.047)	0.264*** (0.047)	-0.052*** (0.019)
Christie's or Outside Guarantee	0.334*** (0.055)	0.388*** (0.055)	0.389*** (0.055)	-0.050*** (0.018)
Outside Guarantee	1.444*** (0.237)	1.615*** (0.220)	1.617*** (0.221)	-0.150*** (0.056)
LE (Low Estimate)				0.535*** 0.011
HE (High Estimate)				0.451*** 0.011
constant	8.689*** (0.002)	8.223*** (0.002)	8.601*** (0.002)	0.407*** (0.009)
Sale Fixed Effects	yes	yes	yes	yes
Observations	408,151	408,151	408,151	408,151
R-squared	0.584	0.619	0.621	0.905

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3: All Types of Auctions

	(1)	(2)	(3)	(4)
	ln P	ln LE	ln HE	ln P
Christie's Guarantee	0.260*** (0.048)	0.344*** (0.047)	0.353*** (0.046)	-0.084*** (0.016)
Christie's or Outside Guarantee	0.534*** (0.043)	0.475*** (0.042)	0.486*** (0.042)	.060*** (0.019)
Outside Guarantee	3.209*** (0.437)	3.347*** (0.423)	3.358 (0.427)	-0.101* (0.060)
LE (Low Estimate)				0.465*** (0.005)
HE (High Estimate)				0.522*** (0.005)
constant	7.861*** (0.001)	8.223*** (0.001)	7.825 (0.001)	0.305*** (0.005)
Sale Fixed Effects	yes	yes	yes	yes
Observations	1,307,507	1,307,507	1,307,507	1,307,507
R-squared	0.537	0.558	0.569	0.897

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

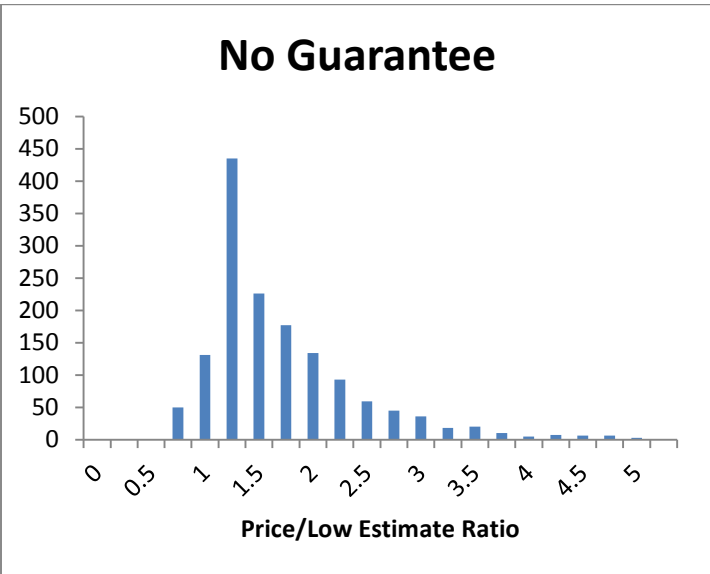
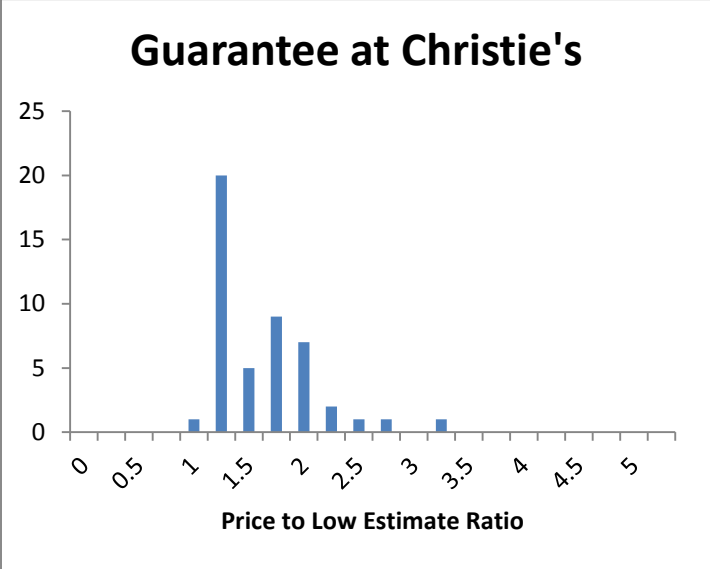
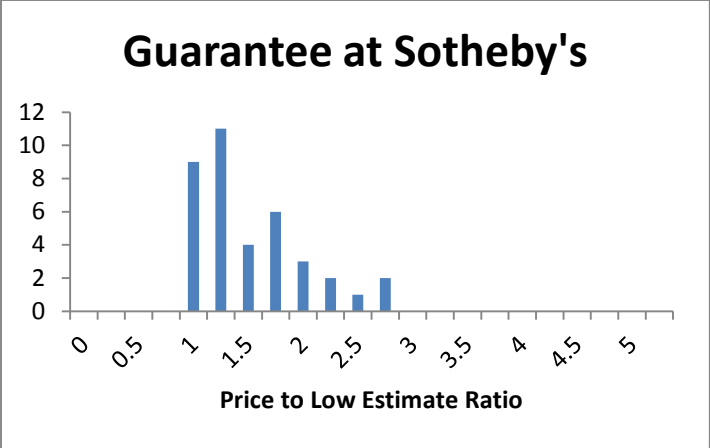


Figure 1