Auction House Guarantees for Works of Art

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Abstract

Auction houses use both in-house and third-party guarantees for sellers who are concerned about the risk that not enough bidders will enter the auction for their works. Auction houses are compensated for guarantees by buyers' commissions and successful sales after attracting important works of art. Sellers compensate third-party guarantors by splitting the excess of the final sale price over the guarantee. The guarantor can bid in the auction, and at Christie's, the third-party guarantor still receives a share of the difference between the winning price and the guarantee price, even if he wins the auction, which means the guarantor has a "toehold". We explore the effect of guarantees (both in-house and third-party) on prices in art auctions, using a large database of auctions and a smaller database of repeat sales.

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1.0 Introduction

Consignors (sellers) in auctions face risks that no serious bidders will enter an auction. Setting a reserve price is one way for sellers to protect themselves—if the high bid is less than the reserve, the seller retains the object and has the option of trying to sell it again in a later auction. When an object fails to meet the reserve, it is said to be “bought-in”.

The desire to attract valuable items by offsetting the risk of the seller led to a new strategy on the part of major auction houses—price guarantees. If an item’s hammer price is less than the guarantee, the auction house buys the item for the guarantee price. In return for the guarantee, the seller agrees to sell a very valuable item through that particular auction house. The auction house receives the buyer's premium for the item (between 12% and 25%, depending on the hammer price), the seller's commission for the item (privately negotiated) and has a "high-profile" piece that anchors the sale. The auction house in some circumstances may also receive a percentage of the difference between the sale price and the guarantee, but this is all privately negotiated between the seller and the consignor and differs by item and seller.

Auction houses became dissatisfied in playing the role of guarantor after facing large losses.[1] The auction houses had become accustomed to relying on guarantees to attract consignments, so they searched for alternatives. One recent development is the third-party guarantee, also known as the irrevocable bid. The auction house finds a potential buyer who agrees to pay a guaranteed price if the hammer price is lower. If the hammer price is higher, the seller and the guarantor split the difference after the commission, with some exceptions.

The reputable auction houses do not allow sellers to bid in auctions (so-called shill bidding). These houses do allow part-owners of an object to bid, as in a divorce or estate sale. Guarantors are clearly similar to part-owners, but they choose to take on that role. At both houses, the third-party guarantor is allowed to bid in the auction, but at Sotheby's, the third-party guarantor cannot collect the financing fee if he wins the auction. At Christie's, the third-party guarantor receives a share of the difference between the winning price and the guarantee price,

[1] 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 guarantees $180 million worth of works, but only raised $86 million. This disastrous sale was one of the reasons that Francois Arnault sold the company in 2002 to Simon de Pury after losing over $400 million dollars.

even if he wins the auction. This gives the guarantor an advantage in bidding for the item against another potential buyer. Currently, both in-house and outside guarantees are very much in use and have elicited criticism from the popular press.[2]

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 first analyze this question by examining the situation theoretically and then we turn to the data. The dataset that we use is a unique dataset that consists of all items auctioned at Christie's from 2001 to May 2011. We have final price, high and low price estimates, date, and the special notice, which indicates whether or not there was 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 irrevocable bids, and which auction houses use them. Section 3 describes the theoretical predictions, starting with the toehold structure of outside guarantees at Christie's, then the no-toehold structure of Sotheby's, and finally the house guarantees. Section 4 describes the data and summary statistics, section 5 describes the empirical model and results, section 6 presents further evidence on outside guarantees at both Christie's and Sotheby's, and section 7 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

[2] Sotheby's has publicly re-entered the in-house guarantee business. According to a September 6th, , 2013 *Bloomberg* article, the Sotheby's Chairman and Chief Executive William Ruprecht stated in an August 6 conference call that Sotheby's increased its borrowing in order to provide up to "$300 million of net outstanding guarantee exposure." According to a November 28th article by Charlotte Burns 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* reported on the strong interest among collectors to offer guarantees in the May 2014 sales.

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 elsewhere, or taken off the market. It is often believed that when an item goes unsold, its value has been harmed.[3]

Because of the fear of an item going unsold, the process of guaranteeing prices started. But guarantees can be expensive for the auction house, as noted by the *Art Newspaper* for Phillips de Pury above. According to *The Economist*, 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. The counterparties on these guarantees tend to be art dealers or owners of significant art collections; individuals in both groups are well-informed about the art market.

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." 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.[4] 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 Sotheby's, the third-party guarantor is not allowed to claim a financing fee if they bid in the auction and win the object, but at Christie's they are allowed to bid and claim the financing fee. Please see Table 1 for wording of special notices at Christie’s.[5]

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[3] Beggs and Graddy (2008) showed that a work that fails to sale achieves a return on average of 30% less than other works of art.

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

[5] 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 "○" 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 "○" will not be used for each lot.”

Also included in the pre-sale catalogue and online listing of upcoming lots is information about the title of a painting, the artist, the size of the painting, and the medium. The auction houses also publish a low and a high pre-sale price estimate for the work. The auction houses do not publish, and indeed are very secretive about, the seller's reserve price for the work of art. By convention, the secret reserve price is at or below the low estimate.

3.0 Theoretical Predictions

The primary role of the guarantee can be thought of as insurance to the seller. The seller is passing the risk of the item not selling to the guarantor in return for sharing the gain when it sells for more than the guarantee. The sharing of the gain (and any difference between the guarantee price and the expected price) 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 (Brearley 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).[6] 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

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"Lots with this symbol "⊃" 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)"

[6] 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.

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.

Ideally, the question we would like to answer is whether items with guarantees fetch different prices, and whether these prices differ if the guarantee is in-house or by an outside guarantor

3.1 Outside Guarantees with a Toehold

The theory behind an auction with an outside guarantor who is allowed to bid and receives a portion of the winning bid, even if he is the winning bidder, has already been extensively analyzed in other settings. This is the Christie's guarantee environment and matches closely the case of a bidder in a corporate takeover who has an initial stake in the firm, which is called a toehold (Bulow, Huang, and Klemperer (1999)).[7] Similar situations arise in other auction settings such as bidding rings and creditors' bidding in bankruptcy auctions, among others. The predictions hinge upon whether bidders have primarily common values or private values.[8]

Some of the auction literature is inspired by corporate takeover processes, which is close to a common value setting. Often, the first step in a takeover is that a potential buyer signs an agreement to buy at a set price and receives a guarantee of a "bust-up fee" in the event the firm is sold to another buyer. Thus, this bidder effectively can buy the firm at a discount relative to other bidders. In other cases, one possible buyer has an initial ownership stake in the target company. In the event of a takeover by another party, this buyer sells his shares at a higher price

[7] As noted above, at Sotheby's the outside guarantor does not have a toehold, because if he wins the auction, he must pay the full price that he bid (i.e. he is not refunded the difference between his guarantee price and the winning bid, as at Christies). Once the hammer price rises above the guarantee price, the guarantor has no advantage over any other bidder.

[8] See Engelbrecht-Wiggans (1994), Burkhart (1995), Singh (1998), Klemperer (1998), Bulow, Huang, and Klemperer (1999) for bidding ring, toehold and bankruptcy 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.

than the pre-takeover price. This buyer also pays less than another bidder because he does not buy his own shares. The “discount” is proportional to the final selling price.

A similar asymmetric bidding situation arises with a “stalking horse” bidder in a bankruptcy auction, who makes a bid on a lot in advance of the auction and receives compensation when he does not obtain the lot (Li (2013) and references cited therein).

The guarantor, when she can bid in the auction, resembles a buyer who is favored by a discount (since she only pays 50% of the price above the guarantee level). McAfee and McMillan (1989) consider this form of buyer discount in a procurement setting. However, the discount is only an optimal mechanism for the seller if the guarantor has been identified as a buyer with a lower expected reservation value, which seems unlikely when art guarantors are major collectors.

3.1.1 The Common Values Case

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. Otherwise, the situation would be one of pure common values, where 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 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 price) with the buyer.

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.[9]

Third, in open-outcry auctions with common or affiliated values, a bidder reveals some information about her valuation when she bids. A guarantor can effectively make a bid at the guarantee price without revealing any information. However, the notice to buyers may itself convey information about the potential market for the item, providing upward pressure on price.

3.1.2 The Private Values Case

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.[10]

The 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

[9] With telephone or other proxy bidding, bidders may not know the identities of rival bidders.

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

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 and in excess of that level if she is risk-neutral. 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.

To conclude, the price predictions hinge upon whether or not a private values model or a common values model more accurately describes an art auction. As noted above, most guarantors are well-known dealers; *a priori*, we would argue that art auctions are mostly common value. Thus, we would predict a decline in price if the guarantor can bid in the auction, unless the signaling effect of the guarantee is strong. 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).

3.2 Outside Guarantees without a Toehold

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 common values, the guarantee price will exceed the seller's private reserve, so that the minimum price paid by a bidder other than the guarantor will be higher with a guarantee. There is still the possible effect that the existence of the guarantee conveys information to potential buyers about the market for the item.

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

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. In the common values case, one may also expect a signaling of values effect that may increase the price.

3.4 Theoretical Summary

To summarize, we have analyzed six different cases: the private and common values cases of outside guarantees with a toehold (Christie's), the private and common values case of guarantees without a toehold (Sotheby's), and the private and common values cases of in-house guarantees. In all private values cases and in the common values cases of an in-house guarantee or at Sotheby's, we would expect the outside or in-house guarantees to raise the sale price. At Christie's, because the outside guarantor can bid in the auction and therefore may discourage other bidders, the outside guarantee could potentially decrease the final price.

4.0 The Data and Summary Statistics

The data for this study were collected online. In total, from the beginning of 2001 through June of 2011, we have over 1.3 million observations. 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.

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 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 cut down somewhat on the labor required in assembling a repeat sales dataset and create a slightly more homogeneous sample.

Table 1 presents a quick snapshot of the full data set. The typical wording for a Christie's only guarantee is given by footnote 1 of Table 1. As is evident from the table, this wording was

only used until 2006. From 2006 to 2010, Christies did not distinguish an in-house guarantee from an outside guarantee, as is evident from the wording in footnote two 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.

Table 2 summarizes the guarantees by department. 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 did 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.

Table 3 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 market for high-end art at the time.

While the department is not explicitly listed, we do know the title of the sale (e.g. Post-War and Contemporary Art) for all items. We can 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. 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".

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."

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 differences in the Christie's dataset is to regress the log of the price on the log of the estimate, a dummy variable indicating a Christie's in-house guarantee only, a dummy variable indicating a Christie's in-house or outside guarantee, and a dummy variable indicating an outside guarantee only. Rather than placing a restriction on the relative importance of the low and high estimate, we include

both together in our primary regression.[11] We include auction-specific fixed effects to further control for the heterogeneity of different items in different auctions.

$$\ln P = \upsilon * \ln E + \alpha * G1 + \beta * G2 + \gamma * G3 + \sum_{n=1}^{N-1} \delta_n * A_n + constant + \epsilon_{in}$$

In the above equation, P is the price at which an item sells (including commission), E is either the auctioneer's estimate (both low and high estimates are included, with υ allowed to vary for each), G1 is a dummy variable equal to 1 if the item has a Christie's in-house guarantee only, G2 is a dummy variable equal to 1 if the guarantee cannot be distinguished between in-house or outside by the sales note, and G3 is a dummy variable equal to 1 if the sales note indicates an outside guarantee. The A_n variables are fixed auction effects, and ϵ_{in} is an error term that varies by item and auction.

In columns 1 through 4 of Table 4 we present the results for the entire sample of works of art, identified by the key words as described above. Before estimating the above model, we first regress log price on the regressors without including 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. It is interesting to note 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. The effect of the guarantees on the high estimate and the low estimate appears to be nearly identical. Column 4 estimates the above model, placing the low estimate and the high estimate on the right hand side. We find a small negative effect on the in-house guarantee and on items where we cannot distinguish between an in house and outside guarantee. For items that we have identified as having an outside guarantee, we find a slightly larger significant negative effect in the all art sample. [12]

[11] While there is clearly co-linearity between the low and high estimate, our purpose is to control for this estimate as well as possible, rather than placing a restriction on the format the estimate takes.

[12] In Appendix Table 1, 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

Columns 5 through 8 restrict the sample to evening and important sales of Impressionist and Contemporary art. We restrict the sample in this way as the bulk of the items with sales notes indicating an outside guarantor occur in these types of sales, and our sample also becomes much more homogenous. We can also compare these findings with our subsequent findings using data from both Christies and Sotheby's. 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 effect on price once the value of the item is taken into account and once heterogeneity of the items being auctioned is sufficiently taken care of 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. This yielded a sample of 784 observations with a pair of sales in which the second sale might have had a guarantee. 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).

The dates of previous sales range from 1962 to 2010. We estimated 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 are only available for later sales, 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

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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.

[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.

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]

6.0 A Further Sample and Test

Because Christie's had only started to note those items with outside guarantors towards the end of our sample, we collected further data at both Christies 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 6 presents a quick snapshot of our data collection.

Table 6 shows that there are approximately equal numbers of observations (775 at Christie's and 796 at Sotheby's), and approximately equal 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. In Table 7, we perform regressions similar to the regressions performed in Table 4.

In these regressions, we only identified one type of guarantee, an outside guarantee. As is evident from column 1 and is consistent with our previous results, showing no effect of guarantee on price once the value of an item is taken into account. When the Christie's and Sotheby's guarantees are tested separately, the point estimates of the effects of the magnitude of the different guarantees are nearly identical, despite the toehold at Christie's and the absence of any toehold at Sotheby's.

7.0 Interpretation and Conclusion

[14] The coefficients on the low and high estimate is 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 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.

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 conscientiously and systematically change the estimates for guaranteed items because of the way in which estimates are given, but even if this were the case this would affect our estimates through co-linearity of the pre-sale estimate with the guarantee. Our errors may be overestimated, but our coefficients are unbiased. The size of the coefficients on the guarantees are in all case 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 (at least some common value element). 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 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 other buyers.

The May 5, 2014, *New York Times* article describes guarantees as "fueling a speculative fever". Our results find little evidence for guarantees pushing prices. Researchers looking to

[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 could potentially affect the error estimates, but not the size of the coefficients.

find trends in art auction prices should remain alert to the use of guarantees and possibly track guaranteed and non-guaranteed sales separately.

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Appendix

The Private Values Model with a Toehold

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 the seller of the item have a valuation equal to v_0. 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 $F(v)$.

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

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

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:

$$v_G\left[F(p_G)\right]^n + Expected\ \text{Re}venue - p_G$$

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

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

A guarantor choosing a guarantee price would be maximizing:

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

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:

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

It may be useful to write this slightly differently as:

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

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:

$$(v_G - p_G)(p_G)^n + E\left(\frac{1}{2}\left[p - p_G\right] \middle| p > p_G\right)$$

$$+E\left(v_G - p \middle| p > p_G\right)\Pr(\textit{guarantor wins above } p_G)$$

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 $\frac{1}{2} max\{ v_2 - P_G, 0 \}$. 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:

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

$$+E\left(v_G - p \middle| p > p_G\right) \Pr(guarantor\ wins\ above\ p_G)$$

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 ananlysis of the private values case does not change.

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	0	10	12	48,738
2001-2011	1943	1728	26	1,319,809

[1]On 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.

[2]On 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.

[3]On 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

[a]Prior to 2006, departments were not generally listed on the webpage that was accessed.

Table 3: 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	

Table 4: Art Auctions at Christies

	All Art				Evening and Important Sales of Contemporary and Impressionist Art			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln P	ln LE	ln HE	ln P	ln P	ln LE	ln HE	ln P
Christie's	0.209***	0.265***	0.264***	-0.052***	0.373***	0.446***	0.430***	-0.026
Guarantee	(0.049)	(0.047)	(0.047)	(0.019)	(0.088)	(0.091)	(0.091)	(0.027)
Christie's	0.334***	0.388***	0.389***	-0.050***	0.426***	0.525***	0.516***	-0.048*
or Outside	(0.055)	(0.055)	(0.055)	(0.018)	(0.080)	(0.081)	(0.081)	(0.028)
Guarantee								
Outside	1.444***	1.615***	1.617***	-0.150***	1.463***	1.636***	1.634***	-0.024
Guarantee	(0.237)	(0.220)	(0.221)	(0.056)	(0.254)	(0.231)	(0.232)	(0.068)
LE				0.535***				0.493***
(Low Estimate)				0.011				0.080
HE				0.451***				0.416***
(High Estimate)				0.011				0.080
constant	8.689***	8.223***	8.601***	0.407***	13.785***	13.328***	13.677***	1.519***
	(0.002)	(0.002)	(0.002)	(0.009)	(0.017)	(0.017)	(0.017)	(0.096)
Sale Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Observations	408,151	408,151	408,151	408,151	3,945	3,945	3,945	3,945
R-squared	0.584	0.619	0.621	0.905	0.319	0.332	0.333	0.898

Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 5: 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	-0.138	-0.138	-0.136	-0.030
	(0.188)	(0.224)	(0.245)	(0.247)	(0.150)
Christie's or Outside Guarantee[t]	0.512***	0.373***	0.455***	0.463***	0.019
	(0.120)	(0.139)	(0.152)	(0.153)	(0.093)
ln (Low Estimate (Sale)) - ln (Low Estimate (Purchase))					0.278***
					(0.089)
ln (High Estimate (Sale)) - ln (High Estimate (Purchase))					0.482***
					(0.093)
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

Repeat sales are estimated using the Case-Shiller method.

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

[t]The 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."

Table 6: Summary Statistics for Contemporary and Impressionist Evening Auctions, 2010-February 2012

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

Table 7: Impressionist and Modern Art Auctions at Christies and Sotheby's
2010-February 2012

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

Appendix Table 1: All Types of Auctions

	(1) ln P	(2) ln LE	(3) ln HE	(4) ln P
Christie's Guarantee	0.260***	0.344***	0.353***	-0.084***
	(0.048)	(0.047)	(0.046)	(0.016)
Christie's or Outside Guarantee	0.534***	0.475***	0.486***	.060***
	(0.043)	(0.042)	(0.042)	(0.019)
Outside Guarantee	3.209***	3.347***	3.358	-0.101***
	(0.437)	(0.423)	(0.427)	(0.060)
LE (Low Estimate)				0.465***
				(0.005)
HE (High Estimate)				0.522***
				(0.005)
constant	7.861***	8.223***	7.825	0.305***
	(0.001)	(0.001)	(0.001)	(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