

REVIEW OF THE LITERATURE

ANCHORING

Anchoring is a well-studied bias with over 40 years of research in psychological and behavioral fields¹. The seminal work on anchoring was first conducted by Tversky & Kahneman (1974), who conducted the experiment described in the introduction². The anchoring effect is extremely complex, and many studies have attempted to understand its nature and implications. For instance, some studies show that people formulate estimates more quickly when provided with numbers to anchor on³, while others show that anchoring decreases, but does not altogether vanish, with increased cognitive ability⁴. Other work demonstrates that anchoring is extremely difficult to avoid, even if the anchors are obviously incorrect.⁵ A myriad of studies exist on anchoring: for a comprehensive survey of the anchoring literature, see Furnham & Boo (2011)⁶.

¹ Furnham, Adrian, and Hua Chu Boo. "A literature review of the anchoring effect." *The Journal of Socio-Economics* 40.1 (2011): 35-42.

² Tversky, Amos, and Daniel Kahneman. "Judgment under uncertainty: Heuristics and biases." *science* 185.4157 (1974): 1124-1131.

³ <http://soco.uni-koeln.de/files/jpsp73.pdf>

⁴ Bergman, Oscar, et al. "Anchoring and cognitive ability." *Economics Letters* 107.1 (2010): 66-68.

⁵ Strack, Fritz; Mussweiler, Thomas (1997). "Explaining the enigmatic anchoring effect: Mechanisms of selective accessibility." *Journal of Personality and Social Psychology* 73 (3): 437–446. doi:10.1037/0022-3514.73.3.437.

⁶ Furnham, Adrian, and Hua Chu Boo. "A literature review of the anchoring effect." *The Journal of Socio-Economics* 40.1 (2011): 35-42.

Within economics generally, various work has been conducted with historical market data by examining prices for unchanging goods with shifting demand to assess potential anchors^{7 8}. Much of the anchoring research in economics uses experiments, surveys, or multiple-choice tests to understand questions about how individuals form estimates and judgments in the presence of an anchor^{9 10 11}. The bias has been studied in many socioeconomic contexts such as accounting¹², real estate¹³, the courtroom¹⁴, public goods¹⁵, and international finance¹⁶. Of course, anchoring has been researched in the context of auctions as well^{17 18}. For example, one bizarre experiment was conducted by Prelec and Ariely (2006), who first asked students to write down the last two digits of their Social Security number, then bid for various items such as chocolate, computer

⁷ Rajendran & Tellis (1994); Greenleaf (1995); Geltner (2011); Dougal et al. (2012).

⁸ Furnham, Adrian, and Hua Chu Boo. "A literature review of the anchoring effect." *The Journal of Socio-Economics* 40.1 (2011): 35-42.

⁹ Frykblom, Peter, and Jason F. Shogren. "An experimental testing of anchoring effects in discrete choice questions." *Environmental and resource economics* 16.3 (2000): 329-341.

¹⁰ Winter, Joachim. "Bracketing effects in categorized survey questions and the measurement of economic quantities." (2002).

¹¹ Flachaire, Emmanuel, and Guillaume Hollard. "Starting point bias and respondent uncertainty in dichotomous choice contingent valuation surveys." *Resource and energy economics* 29.3 (2007): 183-194.

¹² Kinney Jr, William R., and Wilfred C. Uecker. "Mitigating the consequences of anchoring in auditor judgments." *Accounting Review* (1982): 55-69.

¹³ Buccianeri, Grace W., and Julia A. Minson. "A homeowner's dilemma: Anchoring in residential real estate transactions." *Journal of Economic Behavior & Organization* 89 (2013): 76-92.

¹⁴ Mussweiler, Thomas. "Sentencing Under Uncertainty: Anchoring Effects in the Courtroom1." *Journal of applied social psychology* 31.7 (2001): 1535-1551.

¹⁵ Green, Donald, et al. "Referendum contingent valuation, anchoring, and willingness to pay for public goods." *Resource and Energy Economics* 20.2 (1998): 85-116.

¹⁶ Nianhang, Xu, and Wu Shinong. "A Study on Anchoring Effect for Non-tradable Share Reform of Listed Companies in China [J]." *Economic Research Journal* 1 (2007): 009.

¹⁷ Lucking-Reiley, David, et al. "Pennies from ebay: The determinants of price in online auctions*." *The Journal of Industrial Economics* 55.2 (2007): 223-233.

¹⁸ Ku, Gillian, Adam D. Galinsky, and J. Keith Murnighan. "Starting low but ending high: A reversal of the anchoring effect in auctions." *Journal of Personality and social Psychology* 90.6 (2006): 975.

equipment, or a textbook¹⁹. The students who had higher digits submitted significantly higher bids, even when explicitly reminded that Social Security numbers are random quantities that carry no inherent meaning. In the case of a '98 Cotes du Rhone wine, the high-digit students submitted bids that were, on average, over three times what the low-digit students had submitted. Wolk and Spann (2008) study bidding in online auctions in the presence of an anchor²⁰. They find that bidders tend to respond strongly to internalized anchors such as knowledge of past prices for a good, while they respond to external anchors (such as advertiser-suggested bids) just moderately, and only when those numbers are not implausibly high.

ANCHORING AND ART AUCTIONS

The art auction market is no exception to anchoring, and the literature shows that first numerical impressions do seem to significantly impact prices, auctioneer estimates, and sale volume. Here, we provide an overview of research that studies anchoring in the art market, which is still a highly nascent topic.

To our knowledge, a discussion paper by Beggs & Graddy (2005) is the first to examine anchoring effects (i.e. "reference dependence") as well as loss aversion²¹ in the

¹⁹ Ariely, Dan, George Loewenstein, and Drazen Prelec. "Tom Sawyer and the construction of value." *Journal of Economic Behavior & Organization* 60.1 (2006): 1-10.

²⁰ Wolk, Agnieszka, and Martin Spann. "The effects of reference prices on bidding behavior in interactive pricing mechanisms." *Journal of Interactive Marketing* 22.4 (2008): 2-18.

²¹ Beggs, Alan, and Kathryn Graddy. "Testing for reference dependence: An application to the art market." (2005).

art auction market. To identify anchoring – specifically, the marginal impact of past price on current price (which is our definition) – they first use two datasets of repeat auction sales of Impressionist and Contemporary paintings, including not only hammer price but also hedonic characteristics such as artist and medium. The Impressionist dataset was originally collected by Orley Ashenfelter and Andrew Richardson at Princeton University in 1992, while the Contemporary dataset was constructed by Kathryn Graddy from the archives of Christie's; we use both datasets in our research²²

²³. The regression model of Beggs & Graddy (2005) isolates anchoring effects on the price for a second sale by controlling for hedonic characteristics as well as unobserved inputs into price such as bidder behavior. Beggs & Graddy in this paper, believe anchoring effects on the sale price can primarily be attributed to the buyers. The authors find strongly significant evidence for anchoring in both Impressionist and Contemporary genres, though no significant asymmetry between gains and losses appears for anchoring (and loss aversion is not evident either)²⁴.

The anchoring analysis in that discussion paper is formalized further in Beggs & Graddy (2009), which using the same resale approach and data, dives deeper into

²² Richardson, Andrew. 1992. "An Econometric Analysis of the Auction Market for Impressionist and Modern Pictures, 1980-1991." Senior thesis, Department of Economics, Princeton University.

²³ Beggs, Alan, and Kathryn Graddy. "Testing for reference dependence: An application to the art market." (2005).

²⁴ Loss aversion is another behavioral bias that says losses are felt more strongly than equivalent gains.

anchoring effects on price, presale estimates, and the probability of a sale²⁵. For price, they find that anchoring effects are stronger for Impressionist art pieces than for Contemporary ones, particularly for items that are resold quickly after a first sale. They also find an association between presale low estimates and anchoring, although anchoring does not seem to significantly affect the probability of sale (which is estimated with a probit model). The anchoring models developed by Beggs & Graddy (2009) has been used in later anchoring research such as Leung et. al (2013)²⁶, and forms the basis of our own approach. We attempt to replicate selected results from Beggs & Graddy (2009) in a later section.

Graddy et al. (2014) further extends the work in Beggs & Graddy (2009) and Beggs & Graddy (2005) by studying anchoring (as well as loss aversion²⁷) with more data²⁸. The anchoring part of their model is mostly unchanged from Beggs & Graddy (2009). They again find significant evidence of anchoring, and validate the original paper's finding that anchoring effects are stronger for items that are resold more quickly. However, they express more uncertainty on who to attribute anchoring effects to, whether to buyers, sellers, or auctioneers.

²⁵ Beggs, Alan, and Kathryn Graddy. "Anchoring effects: Evidence from art auctions." *The American Economic Review* 99.3 (2009): 1027-1039.

²⁶ Leung, Tin Cheuk, and Kwok Ping Tsang. "Anchoring and loss aversion in the housing market: implications on price dynamics." *China Economic Review* 24 (2013): 42-54.

²⁷ See also Mei, J., et al. "Loss Aversion? What Loss Aversion? Some Suprising Evidence from the Art Market." *Working Paper*. 2010.

²⁸ Graddy, Kathryn, et al. "Anchoring or loss aversion? Empirical evidence from art auctions." (2014).

Bruno and Nocera (2008) study how anchoring affects presale estimates using a unique dataset of nearly 1,000 Italian paintings that have been sold at least twice (1985-2006)²⁹. They regress the range of presale estimates on a multi-leveled dummy variable for anchoring to account for multiple past prices (anchors). Subsequently, the authors find significant evidence of anchoring. First, the existence of past prices makes the presale estimate range narrower, presumably because the auctioneer grows more confident³⁰. Second, Bruno and Nocera find that the existence of a past price corresponds to the presale estimate range being more closely centered on the true hammer price. Hence, both the bias and variance of the presale estimate range seem to decrease in the presence of anchors. These findings are consistent with what we learned through interviews, namely, that specialists at auction houses do research past sales before formulating estimates (as described earlier).

Even the order in which art pieces are auctioned can beget anchoring effects, as shown in (Hong et al. 2015)³¹. For the semiannual Auction Week, a two-week auction series held every spring and fall across New York City³², Sotheby's and Christie's have an arrangement to alternate who holds their auction first – a natural experiment. Using

²⁹ Bruno, Brunella, and Giacomo Nocera. "Investing in art: The informational content of Italian painting pre-sale estimates." *Available at SSRN 1179183*(2008).

³⁰ Specifically, both the relative and absolute range between low and high estimates.

³¹ Hong, Harrison, et al. "Ordering, revenue and anchoring in art auctions." *The RAND Journal of Economics* 46.1 (2015): 186-216.

³²

26 years of Auction Week data and an adapted version of the resale model in Beggs & Graddy (2009), Hong et al. find that opening sale mean revenues significantly anchor later sales during the rest of an Auction Week. Specifically, they discover that if more expensive paintings are sold first, then Sotheby's and Christie's will pull in higher total revenue (+21% higher), and more works will sell overall (+11% more sales). They state that their anchoring coefficients are quantitatively comparable to those from Beggs & Graddy (2009).

Other behavioral research on art auctions exists, though much of it is more tangential to anchoring. In the art trade, there is the belief that if an art piece is bought in at auction, it becomes "burned" and will sell for less in the future. To test this quantitatively, Beggs & Graddy (2008)³³ use a sample of repeat sales from the Impressionist and Contemporary datasets in Beggs & Graddy (2005). The authors find that on average, burned paintings do seem to sell for significantly less (-30%), particularly if they are resold at the same auction house within 2 years (-37%). Whether this is directly due to buyer perceptions of failure, however, is ambiguous. Sentiment, emotion, and mood are also topics of research. For instance, Canals-Cerda (2012) analyze art auctions and seller reputations on eBay, and discover that negative feedback

³³ Beggs, Alan, and Kathryn Graddy. "Failure to meet the reserve price: The impact on returns to art." *Journal of Cultural Economics* 32.4 (2008): 301-320.

very significantly lowers sale price and the probability of sale³⁴. Penasse et al. (2014) collect survey data on sentiment toward selected artists in the art community, and find that strong confidence can predict art returns in the short run³⁵. Furthermore, De Silva et al. (2012) examine if weather, a proxy for mood, significantly impacts art auctions at Sotheby's and Christie's during the period 1990-2007³⁶. They find a weakly significant effect, suggesting that external emotional shocks do affect art auction activity.

In the aforementioned literature, the exact mechanism by which past quantities anchor future ones is treated as a black box; only the impact is noted. This is consistent with our definition of anchoring earlier, as the details of transmission need not involve purely psychological factors. Rather, in this context it is enough to say anchoring occurs when past quantities bias future ones even though hedonic factors should be the only determinants.

ON THIS RESEARCH

It is clear that anchoring is pervasive in the art auction market, especially since empirically and anecdotally, psychological and behavioral factors seem to be significant inputs into auction activity. However, most of the research to date has studied

³⁴ Canals-Cerdá, José J. "The value of a good reputation online: an application to art auctions." *Journal of Cultural Economics* 36.1 (2012): 67-85.

³⁵ Pénasse, Julien, Luc Renneboog, and Christophe Spaenjers. "Sentiment and art prices." *Economics Letters* 122.3 (2014): 432-434.

³⁶ De Silva, Dakshina G., Rachel AJ Pownall, and Leonard Wolk. "Does the sun 'shine' on art prices?." *Journal of Economic Behavior & Organization* 82.1 (2012): 167-178.

anchoring by examining the resale of art pieces. This is problematic because as Beggs & Graddy (2009) acknowledge, it is extremely uncommon to encounter multiple sales of the same artwork. This is further limited by large time gaps between sales, which tend to weaken possible anchoring effects³⁷. Additionally, it is difficult to show resale observations refer to the same art piece, since an artist may create multiple pieces with the same medium, dimensions, and so forth. For instance, Beggs & Graddy (2009) manually cross-checked their resale data against presale catalogs.

Most importantly, a shared (flawed) assumption across much of our aforementioned anchoring literature is that hedonic quality does not change much across auction sales. Thus, in one of our conversations with a specialist at Sotheby's, we were surprised to hear how much artwork can deteriorate over time. Prints may tear accidentally, fade under glass, or if tacked to the wall for decoration will have holes in the corners. The canvas of a painting can weaken over time, and must be "relined" with a new canvas attached to the back for extra support. On the flip side, restoration (often by an unwitting owner) can also harm the value of an art piece. A specialist at Bonham's told us that this is regularly corrected for: protective glaze is scraped off art pieces, retouched paintings is examined under ultraviolet light, and so forth. We suspect these factors explain why Beggs & Graddy (2009) find stronger anchoring effects for Impressionist artworks than for Contemporary ones. Paintings in the former

³⁷ See Graddy et al. (2014); Hong et al. (2015).

category come from classic Impressionists artists such as Renoir and Monet, are an order of magnitude more valuable in both presale estimates and prices³⁸, and are thus probably far better maintained. This preserves their hedonic quality and better allows past sales to anchor future ones.

If an art piece can change over time, how can we test for anchoring? The key is to control for quality differences between an anchor and the current good. In previous literature, the anchor was nearly always a previous sale of the same good. However, if we control adequately for quality changes between the anchor and the current art piece, then we may use related artwork (substitutes) as the anchor instead of past sales. This is the intuition behind our generalization of the original anchoring model in Beggs & Graddy (2009). Developing a systematic measure of substitution to control for quality differences across artwork is not trivial. Yet, as discussed in an earlier section, this is of tremendous value to experts in the field. The role of our research is primarily to understand anchoring effects across sales of related art pieces, which has not been studied in the literature before. However, we hope that our analysis may also shed light on the aforementioned similarity problem.

³⁸ See Table 1 and 2 – sample means – in Beggs & Graddy (2009).