NOBODY KNOWS – BUT THE AUCTION HOUSE?
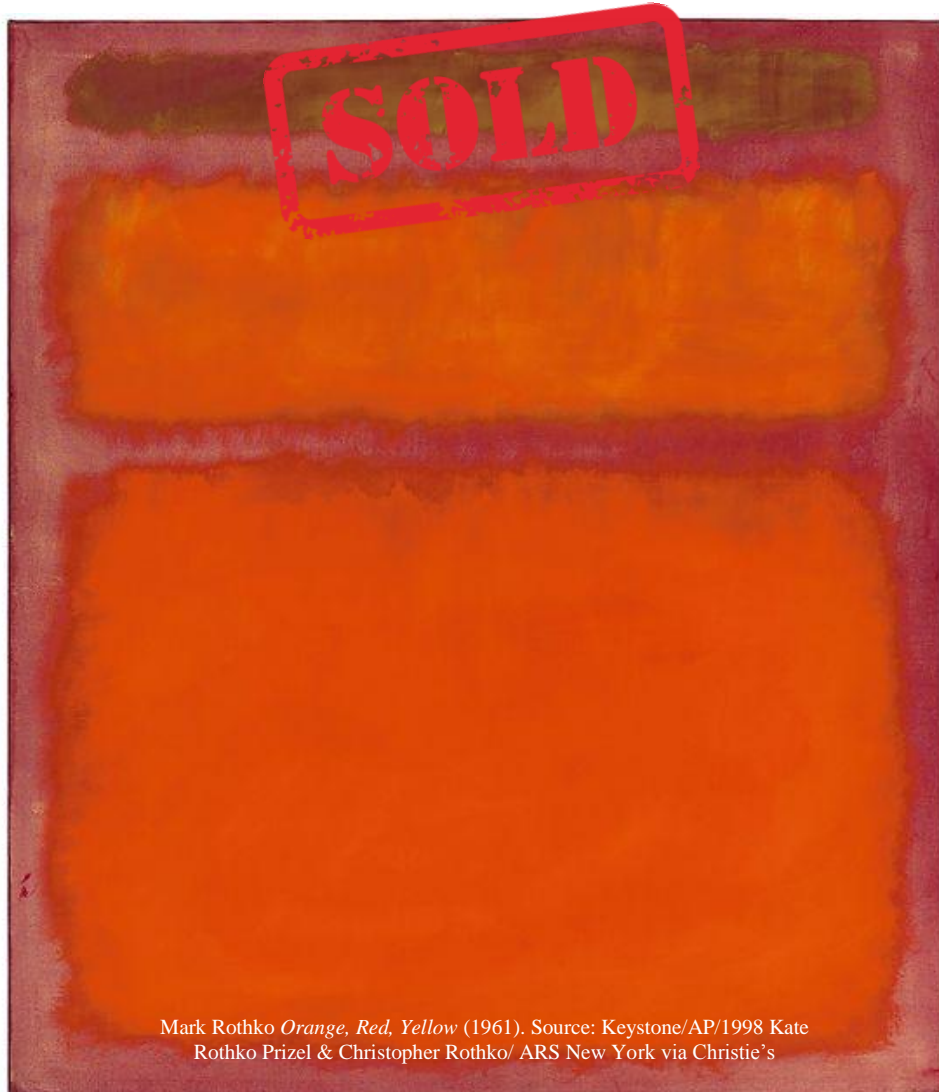
A Study on Pre-Sale Price Estimates of Online Auctioneer Auctionata AG

Mark Rothko *Orange, Red, Yellow* (1961). Source: Keystone/AP/1998 Kate Rothko Prizel & Christopher Rothko/ ARS New York via Christie's

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Abstract

In this thesis we are concerned with estimate bias of online auctioneer Auctionata AG and investigate components influencing bias in our data set of eighteen auctions. Pre-sale estimates are published by most auctioneers and provide the audience with relevant price information in a market where standardized valuation systems are missing. We find that estimates at Auctionata AG are upward biased, but that art of Asian origin and the starting price have a significant positive influence in reducing bias. We further find significant evidence that known provenance and art of deceased artists reduce upward bias in our sample of paintings. Moreover, the order in the catalogue has a significant effect on bias. Contradictory to earlier studies, we do not find evidence for the significance of physical properties and only slight improvement in the accuracy of estimates over a one year period.

Keywords: Art auctions – price estimates – digitalization – Auctionata AG

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I. Introduction

Look, it's my misery that I have to paint this kind of painting, it's your misery that you have to love it, and the price of the misery is thirteen hundred and fifty dollars.

(Mark Rothko)

42 years post-mortem, the auction record for a Rothko was set at a $77,5 million excluding buyers premium, a price exceeding the presale estimate of $35 – to $45 million by 100% (Melikian, 2012). Rothko surely would have been amused by the price of the misery. But beyond these astonishing figures, the underlying question is how both estimate and final value had been determined and more generally speaking what determines the monetary value of works of art. Essentially, the dynamics of the art market are being suspiciously interpreted and the common opinion has been well expressed with Baumol's (1986) famous article "Unnatural Value: or Art as a Floating Crap Game".

However, the art market has its very specific mechanisms in place which cope with the uncertain value of art and the corresponding uncertainty of supply and demand. Within this system, auction houses are the intermediaries, which are not only operating in the public sphere but which also arguably provide the platform, where the value of art is determined optimally (Velthuis, 2011*b*). At the same time, auctioneers provide price estimates prior to auctions, allegedly taking into account their knowledge and expertise in reading the market and foreseeing bidding behavior. The practice of price estimation can both confirm and reinforce their status as the ultimate experts within the market. Accordingly, a substantial amount of academic research has been conducted on estimation processes, auctioneer strategy and estimate bias.

Digitalization is having an impact on the art market, is changing consumption patterns and is giving rise to new auction houses operating online. Yet, to our knowledge, no research has been carried out so far concerning estimates and bias of online auctioneers. At the same time, online auctioneers are making use of techniques similar to established auctioneer houses, such as positioning themselves in the difficult and prestigious task of estimating prices. Observations on the matter do not only add to the existing body of literature, but can also serve to point to avenues for future research and lead to considerations on the similarities and differences between on- and offline auctioneering.

In this thesis, we will make use of fine arts auction results of the German based online auctioneer Auctionata AG[1]. The start-up made headlines in 2013 by breaking the record for a painting sold via an online-only auction with Egon Schiele's *Reclining Woman* for €1.5 million excluding buyer's premium (Strauss, 2013). Using auction results of one auctioneer will serve to make specific statements on price estimates and set them in the context with results of previous research. Correspondingly, the following research question will be guiding the research:

Are pre-auction price estimates of German based online auction house Auctionata AG unbiased?

To complement the findings on the research questions, precision of estimates as well as potential tendencies will also be regarded. Furthermore, we will investigate on specific categories and elements which seem to exhibit deviant behavior from the sample as a whole. Moreover, we will repeat the analysis on bias in a sample containing only paintings and investigate on art work inherent properties influencing the very same.

The remainder of this paper is arranged in the following manner. In chapter 2, we elaborate briefly on the value of art and the valorization system that has been developed around it. This system, the global art market, and its segmentations will be discussed in the following section. The discussion will allow us to deliberate on the market characteristics and the implications for the participants. It will be shown that the market for art diverges substantially from the concept of a perfect market, but that digitalization holds a potential to improve market conditions. In chapter 3 we turn to the practice of estimating prices and present academic reflections on strategic behavior and on the results of past research. The chapter is completed by introducing Auctionata and their internal valorization process. Chapter 4 is concerned with the methods employed in the analysis of Auctionata's auction results. In chapter 5 we present the results, followed by the interpretation of the very same in chapter 6 and concluding remarks in chapter 7.

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[1] Hereafter referred to as Auctionata; the term AG is the German equivalent to public holding company.

II. Art, Market and Digitalization

2.1 Introduction

The value of art cannot be determined objectively. Therefore, we will discuss the well-choreographed system of intermediaries facilitating and beaconing the valorization processes in the art the market in section 2.3. However, due to the nature of the visual arts and the intermediary system, the market is far from being perfect or transparent as elaborated upon in section 2.4. At the same time, we will discuss in section 2.5 that the internet and resulting changes in consumption patterns are starting to unseal the traditional system with the potential to sweeping changes within both primary and secondary art market.

2.2. The Value of Art

The value of art is not equatable or measurable by labour time, material and size, but rather is a social construct. Historical and cultural values as well as the motive of conspicuous consumption influence valorization and in turn the consumption value (Bonus & Ronte, 1997). These determinants are related to aesthetic and artistic values, but neither artistic nor aesthetic values are objective or universal, and, hence, certainly difficult to translate into monetary terms (Oberender & Zerth, 2002; Bonus & Ronte, 1997). Accordingly, demand depends on subjective criteria. These criteria include the purpose of purchase, varying from aesthetic deliberations, to cultural and historical attributed to an artwork, portfolio diversification or conspicuous consumption elements (Velthuis, 2011*a*).

At the same time, it is the opinion of non-commercial and commercial cultural institutions that influences and beacon a society's perception of aesthetic, artistic, cultural and historical values (Velthuis, 2011*a*). The behavior of these experts has a signaling function with regards to the price and cultural value as they make the selection of what is worth receiving attention and what is not. Non-commercial intermediaries such as art schools and critics act as gatekeepers making the selection, followed by museums which reinforce by exhibiting selected art works. The pre-filtered art works in turn are being brought to the market by humdrum agents (Caves, 2003). Neo-classical economic theory would suggest for a scarce good with a monopolistic market and credence good appeal such as art to be sold via means of a public auction (Velthuis, 2011*b*; Ashenfelter, 1989; Sagot-Duvauroux, 2011). During an auction the true, current market value "as [an] adequate approximation of true equilibrium price" (Marinelli & Palomba, 2011, p. 213) is determined. However, this is seldom done, if not even avoided in the dealer market where set prices are the norm (Velthuis, 2011*b*).

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2.3. The Global Art Market[2]

The market for art is an extreme case of a market where the supply and demand for heterogonous goods is being organized in the absence of a standardized valuation system (Velthuis, 2011a; Oberender & Zerth, 2002; Bonus & Ronte, 1997; Robertson, 2005). No such system can be in place, when personal taste, aesthetic perception, motives of purchase, cultural values attributed determine individual demand functions and willingness to pay (Singer & Lynch, 1994).

The market can be devided into two main segments. The primary art market is dominated by dealers and galleries selling art works for the first time via posted prices and negotiations (Velthuis, 2005). In turn, in the secondary market art is being "re-cycled" (Singer & Lynch, 1994, p 199) by auction houses, via private sales or through galleries and dealers. It has been argued, that auction houses compose their own segment, namely the tertiary market (Robertson, 2005; Sagot-Duvauroux, 2011; Singer and Lynch, 1994), but as the nature of the business is equal, namely re-selling, we follow Velthuis' division of the market into two segments (Velthuis, 2011a).[3]

The art market has no central trading area, although there are centers to be identified, such as London for old masters and New York for contemporary, impressionist and modern art (Velthuis, 2011a). Nevertheless, commercial markets for specific genres and media can be found everywhere. The market itself can also be segmented by types of media, such as sculptures, furniture, paintings etc. (Bates, 1983). Each of these media types has its own market segments with respective participants. Within these segments, further sub-segments according to styles can be detected. Accordingly, the behavior and characteristics of supply and demand vary across specific styles and place (Marinelli & Palomba, 2011). Moreover, non-reproducible art works within each sub-segment are differentiated, unique und non-substitutable even within the oeuvre of one particular artist (Heereman von Zuydtwyck, 2013). In essence, every painting or work of art has its own market with its own specific supply and demand curves and therefore, it would be more appropriate to speak of the monopolistic markets for art rather than the art market (Velthuis, 2011a)

Coffmann (1991) distinguishes the market into two segments, the organized and the unorganized market. In the unorganized market informal transactions are taking place, such as in antique shops, flea markets and via classifieds. In contrast, the organized market is highly

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[2] The art market is not to be confused with the art world, which has different features and includes non-commercial intermediaries and the artists themselves. Cf. A. Joy & J.F. Sherry (2003). Disentangling the paradoxical alliance between art market and art world, *Consumption Markets & Culture, 6 (3),* 155 – 181.
[3] The illicit trade and trade with forgeries can be seen as an additional segment (Robertson, 2005).

institutionalized and organized with participants operating on a global scale. The sales volume of the organized art market has been estimated at € 48.7 billion in 2013 (Mc Andrew, 2014) whereas auction sales accounted for 47% of this value.

2.4. A perfect market?

A perfect market implies that none of the participants to have a large market share and for all products to be regarded equivalent substitutes (Krugman & Wells, 2008). Although the concept of the perfect market is of a theoretical nature, the art market departs rather vastly from this theory. Both above mentioned conditions are not fulfilled as the owner of an art work has the full market share, hence a monopoly, and art works are not substitutable (Ashenfelter & Graddy, 2003; Velthuis, 2011*a*). Further, although it is relatively easy to enter the (secondary) market as a supplier, becoming an intermediary such as an auctioneer is constraint to high entry barriers and to having access to key resources by means of reputation and established client base (Ashenfelter & Graddy, 2011) . The seller on the other hand is bound to a rather fixed auction calendar making the market rather illiquid (Velthuis, 2011*a*).

Additionally, and arguably the main characteristic of the market, asymmetric information is a dominant feature (Coffman, 1991). The so called 'Economics of Lemons' (Krugman & Wells, 2008, p. 462), a concept analyzed by Akerlof (1970), describes markets in which the quality of an item is only known to the seller and therefore gives rise to forgeries (Velthuis, 2011*a*). The search costs to reduce the asymmetry and the risk to purchase a 'lemon' can be high for the buyer, both in monetary terms as well as in terms of spent time. Commissioning an expert to authenticate an artwork of any price segment can be expensive and finding respective expert tedious to begin with (Velthuis, 2011*a*). Likewise, sellers have high opportunity costs in finding the optimal buyer and overcoming the information asymmetries with regards to the current market value, hence willingness' to pay.

The asymmetric information issues and the lemon problem can be overcome by turning to an intermediary directly, an auctioneer for example. Auctioneers undertake the collection of all available knowledge on the art work and the market conditions, estimate a price and gather the relevant audience. The costs are later compensated for in the form of premiums charged to both buyer and the seller for the service of gathering and informing interested buyers (Gérard-Varet, 1995).[4] These transaction costs are proportionate to the sales price and have to be paid in addition to above mentioned search costs, making transactions in

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[4] According to Ashenfelter and Graddy (2011), buyer's premiums are charged on a 10% to 25% sliding scale according to the sales value in most auction houses and are non-negotiable. Similar scales exist for the seller's premium but they are negotiable.

the art market a comparably expensive endeavor (Ashenfelter and Graddy, 2003; Velthuis, 2011*a*).

Further, the art market is not anonymous. Due to the information asymmetries, personal relationships and a well-connected network based on trust and reputations are key, especially for blue-chip art, art of great monetary value (Velthuis, 2011*a*). Although, buyers and sellers can remain anonymous during transactions, they are known to the auctioneer who is free to make use of their knowledge for future transactions.

The lack of anonymity is accompanied by a lack of transparency. Although this seems illogical at first sight, auctioneers and other intermediaries do protect the identity of their clients, leaving the public uninformed about the whereabouts of an art work (Velthuis, 2011*a*). Moreover, auctioneers are increasingly venturing into private sales, where not only buyers and sellers remain anonymous but the prices paid are unknown as well.[5] Prices for 'comparable' items are often used for estimation purposes and influence willingness to pay, and so does the previous ownership (Marinelli & Palomba, 2011). Clients, especially buyers will have to cope with the lack of transparency and trust the expert opinion (Pardo-Guerra, 2011).

The lack of transparency, asymmetric information and high transaction costs make the art market inefficient and lead to high entry barrier, high average variable costs, high fixed and discovery costs. Uncertain supply and demand "within and across auction packages" (Singer & Lynch, 1994, p.205) lead to long-run economies of scale for the top-tier auction houses and the duopoly at the upper end of a the secondary market, namely Christies and Sotheby's, has certainly no interest in reducing these inefficiencies (Robertson, 2005; Velthuis, 2011*a*). Encapsulating and summarizing these features is Cave's (2003, p. 74) *Nobody Knows principle* as a form of symmetrical ignorance implying high levels of both demand and product uncertainty, a specific issue to be observed in most creative industries (Rossiter & Radbourne, 2003).

2.5. Digitalization

The art market has shown reluctance towards opening up to e-commerce and to adapt to changing consumption patterns (Horowitz, 2012; Mc Andrew, 2010). At the same time, the

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[5] A prominent example of the unknown whereabouts of a painting and its price is Paul Cezanne's 'The Card Players". Rumor has it that the Royal Family of Qatar purchased the painting with the help of private negotiations for US$ 250.000.000 in 2011, but if this transaction actually took place is unknown. http://www.dailymail.co.uk/news/article-2096051/Most-expensive-art-piece-sold-Qatar-buys-C-zannes-The-Card-Players-160m.html ; http://artmarketmonitor.com/2012/03/26/cashing-in-on-cezannes-card-players/

internet can help the market participants to overcome the inefficiencies discussed above (Velthuis, 2011*b*; Mei & Moses, 2005). In the following, the seemingly sudden recent soaring increase of art related e-commerce and online services shall be discussed with a special focus on the secondary market, whereas established intermediaries and new players will be distinguished. This will serve to identify possible changes within the art market and conditions that seem to remain crucial for the trade.

2.5.1 Reluctance towards the Internet

The art market has been growing over the past decade in both volume and value, with only a slight slump during the financial crisis in 2008/2009 (Mc Andrew, 2010). On the one hand this has been explained by an overall increase and interest in art by a sophisticated middleclass as well as the exponential increase of high net worth individuals (Mc Andrew, 2012). On the other hand, the internet holds the possibility for old and new art aficionados to find and buy art around the clock without geographical boundaries or opening hour constraints. These advantages of e-commerce have been identified as early as 2002 by art market scholars but the broad and successful implementation took almost another decade (Oberender & Zerth, 2002; Kollmann, 2002). Mc Andrew (2014) estimated that 5%, € 2.5 billion, of the global art trade has been carried out online in 2013 and is forecasting an annual growth of 25% .

The delay of art e-commerce has mainly been explained with three conditions that explain the delay. Firstly, the quality of pictures has been insufficient until recently to grasp art works fully. Satisfying zooming technologies and high resolution pictures, paired with high speed internet and comprehensive internet coverage have not been the norm in the early millennium years, making browsing and experiencing art online unbearable. Secondly, the public was not yet accustomed to purchasing luxury goods online, leading to failed e-commerce business attempts of well-established dealers (Horowitz, 2012; Mc Andrew, 2012; Heereman von Zuydtwyck, 2014). Arora and Vermeylen (2013*b*) find thirdly, that especially at the high end of the market, personal relationships between dealers and their clients obstructed early attempts.

Not only established dealers failed in the dotcom years,[6] but so did also Sotheby's, twice. Again technological constraints are believed to have hindered the establishment of online auctions of art, but at the same time another set of reasons seems to have been the decisive problem. In collaboration with first Amazon (2000) and then eBay (2002), both firms

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[6] Horrowitz (2012) discuses a collective effort of some established British gallerists to venture into e-commerce, which failed with approximate depths of € 30 million.

that in principle had the expertise to carry out online sales and auctions, Sotheby's failed with spectacular high losses and terminated both collaborations within a years' time (Horowitz, 2012; Martin, 2002).[7] Horowitz (2012) believes that both suppliers and buyers could not make sense of the collaboration between high class brick and mortar auctioneer Sotheby's and low class retail / classified businesses and were therefore hesitant to consign or buy.

These examples can lead to the conclusion, that the failure of reputable and established commercial intermediaries led to a general reluctance of other brick and mortar companies to try themselves and discouraged new players to try at all with one exception, Indian based Saffronart. Online auctioneer Saffronart was established in 2000 by Indian art collectors Dinesh and Minal Vazarani who aimed to create a global platform for Indian art, which by the time was widely disregarded by western auctioneers (Horowitz, 2012; Saffronart.com). The Vazarani's succeeded not only with pioneer platform but they also increased the visibility, appreciation and monetary value of Indian art globally (Horowitz, 2012).

2.5.2. Embracing the Internet

A decade later the initial reluctance has been overcome and it can be argued that two of the conditions discussed have changed. Technology has advanced and with it, consumption patterns of the general public. Now, most commercial intermediaries do have websites and mobile applications, although there are differences in the level of utility (Arora & Vermeylen, 2013*a*). Live bidding, except for the signature evening sales, is possible via mobile applications at both Sotheby's and Christie's and increasingly experiments with online only auctions are being conducted. However, Arora and Vermeylen (2013*a*) find that the live bidding is more of a marketing tool rather than a new business branch. Mc Andrew's (2014) latest art market report confirms as only 1% of the total sales of the duopoly were made online, whereas second tier auctioneers reported 6% online sales on average.

Arora and Vermeylen's (2013*b*) observation on price limits seems to still hold true as Mc Andrew (2010) finds that there seems to be an upper price limit to online art sales as high end dealers are using their web presence as a second showroom rather than as a market place (Mc Andrew, 2010).[8] However, this price ceiling is steadily going up (Mc Andrew, 2014). At the lower and middle segments, below €100.000, actual online transactions are being made in both the primary and the secondary market (Mc Andrew, 2014).

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[7] EBay's art and antiques segment has been introduced already in 1999 and continues to exist until today, but in comparison its turnover in monetary terms is marginal (Heereman von Zuydtwyck, 2014).
[8] High-end galleries have (1) no interest in revealing their prices publicly, (2) offering the same painting over a longer period online gives negative price signals (Horowitz, 2012), (3) dealers prefer to place their artworks with particular collectors (Velthuis, 2005).

The changed conditions are attracting new intermediaries with online-only services to enter the art market and capitalize from increasing art consumption and facilitated global trade. Artist-to-collector platforms and collector-to-collector platforms covering all price segments with different levels of curating sovereignty and exclusivity aim to replace the traditional participants (Heereman von Zuydtwyck, 2014). At the same time, their services are not different from the classic system, but accessibility is increased and search costs reduced. Nevertheless, we have argued previously that the vast amount of new ventures might have an irritating effect for both the supply and demand side leading them to turn to services that are founded or supported by brick and mortar experts such as Saatchi Art (Heereman von Zuydtwyck, 2014).

Besides Saffronart, other online auctioneers have recently opened their virtual gates. We made the following observations: "In the auction segment, Paddle8 (2011) and Auctionata (2012), among others, carry out public sales in the middle and lower price range. Whereas Auctionata offers a wide range of arts, antiques and collectibles, Paddle8 focuses exclusively on fine arts and charity auctions. New competitors in the secondary market seem to have adopted similar sales techniques as the established auctioneers, by making precise information of provenance, condition, size, painter and estimating sales prices. This can be interpreted as a tactic to gain a trustworthy reputation by making use of established mechanisms. Moreover, this tactic sets them apart from eBay, where almost no selection is made and quality standards are not set by acclaimed experts. By hiring veterans from brick and mortar auctioneers and publicly announcing who invests in the firms, Paddle8, Auctionata and alike try to further increase their credibility as art auctioneers. Furthermore, platforms such as Artspace (2011) serve both primary and secondary market, by means of holding auctions, selling art directly from the artists and in the private secondary domain.*"

A last new set of enterprises must be mentioned, with arguably the biggest impact in reducing information asymmetries and improving transparency, namely art databanks (Mei & Moses, 2005; Arora & Vermeylen, 2013*a*). Virtually everybody can obtain information on a specific artwork which had previously been openly exchanged within the art market via data banks such as ArtFact, ArtNet or ArtPrice. Naturally, the use of the databanks is not free of charge, but they do collect and offer a wide range of information that was not accessible to the John Doe before.

To conclude, the internet is reducing information asymmetries, transaction and opportunity costs, transparency concerns and lowers the barriers to enter while the market is becoming more liquid. However, established intermediaries and new ventures found by or supported with knowledge from brick and mortar entities remain to have a competitive

advantage. While anyone can have an opinion, distinguishing the expert from the amateur can be problematic and time consuming (Arora & Vermeylen, 2013*b*); hence customers are likely to turn to established and reputable experts that have served the test of time rather than to new intermediaries (Arora & Vermeylen, 2013*a*). At the same time, the information available via price databanks has the potential to drive customers from established to new intermediaries, as they "might feel fooled for the prices they paid [previously] and try online-intermediaries instead" (Heereman von Zuydtwyck, 2014).

Anyhow, the internet has been and will continue to increase the competition between intermediaries which in turn is likely to further lower transaction and opportunity costs on the supply and demand side.

2.6. Summary

The art market is composed of a large set of monopolistic markets which are characterized by the absence of a standardized valuation system and moderated by intermediaries who match supply and demand, and, in turn, profit from a set of market inherent stipulations. Asymmetric information, high barriers to enter, long-run economies of scale and high transaction costs are predominant and favor the existing system. However, the digitalization of the trade and new information technologies are reducing and can further reduce the inefficiency, making buyers and sellers better off. Still, information asymmetries on quality and price formation remain. Commercial and non-commercial institutions that have developed the expertise to establish pricing norms, match and stimulate demand and reduce uncertainty are as important as ever (Bonus & Ronte, 1997; Oberender & Zerth, 2002; Arora & Vermeylen, 2013*b*).

III. Price Estimation

3. 1 Introduction

As discussed above, it can be argued, that the auction system is the most efficient price mechanism to determine the market value of art. Considering uncertainty, asymmetric information and absent standardized valuation system, it might come as a surprise, that most auctioneers are confident enough about their expert knowledge to estimate prices prior to an auction. In the following the background of this practice will be discussed as well is deliberations presented that concern strategic behavior and its consequences. The discussion will be accompanied by results of academic research on the extent and levels of bias. Moreover, the case of online auctioneer Auctionata will be introduced briefly and it's estimation procedure presented before we turn to the analysis of the very same.

3.2. Estimates, Strategy and Research

Auctioneers established pre-sales estimates in 1973 due to revenue considerations. To shift from a wholesale market for dealers, museums and art professionals, were the supplying dealers had been entitled to 50% of the final sales price, towards attracting individual buyers and sellers and charging them both premiums (Mei & Moses, 2005).

Estimating the price of a work of art necessitates remarkable expertise and in turn is both enhancing and justifying reputation (Ashenfelter, 1989). Price estimates are supposedly being set by taking into account all information circulating in the market and therefore serving as value signals for the individual's price formation process (Dass & Reddy, 2008; D'Souza & Prentice, 2002). Previous to 1973, buyers had to cope with the abovementioned information asymmetries and associated opportunity costs by themselves Ashenfelter (1989). Hodges (2012), Mei and Moses (2005) and D'Souza & Prentice (2002) among others suggest that estimation prices have an impact on the hammer price. Opposed to these views, Gershkov and Toxvaerd (2004) find that buyers are not credulous and behave just as rational in the presence of estimates as in their absence. Although Gershkov and Toxvaerd's (2004) findings are rather interesting, the buyer is very likely to make imperfect decisions due to time constraints and adjusting their private information based on the auctioneer's opinion.

At the same time, auctioneers such as Christie's and Sotheby's set a price window rather than one estimate, a ratio within which they predict the hammer price to lie in. This window, known as the high and low estimate is believed to serving as an indicator on how confident the auctioneer actually is. Hodges (2012), analyzing Impressionist and Modern Art sold at Sotheby's, argues in line with Marinelli and Palomba (2011) that a wide estimation window will reduce the buyers willingness to pay, since the respective work seems illiquid

non-marketable and consequentially, a lower final sales price will be realized. In turn, a small estimation window signals confidence, presumes clear valuation by the market and liquidity and will therefore result in a hammer price closer to the high estimate (Hodges, 2012). Mei and Moses (2005), draw the opposite conclusion, namely that realized prices tend to be higher when the estimation window is larger. Regardless which view one favors, the more accurate the auction house estimates the market value, the more knowledgeable they appear which in turn can influence future consignments and profits (Mei & Moses, 2005).

Accordingly, setting the estimation window is to be seen as one of the crucial activities of an auction house. Its accuracy proves the role as knowledgeable expert of the market and justifies reputation. Correspondingly, established auctioneers have bible-like documents with fixed estimation guidelines (Pardo-Guerra, 2011). With regards to academic research on the translation of aesthetic value into monetary value and price elasticity, reviewing such an estimation guideline would be highly interesting for analyzing the individual elements regarded in the estimation process (Arora & Vermeylen, 2013*b*). Regardless, these guidelines are kept strictly confidential. Pardo-Guerra (2011) recruited an anonymous source from Christie's, who revealed that the key factors for price estimation are the previously achieved prices of the very same art work, comparable items, the provenance and the current market situation. Provenance is relevant for two important reasons. Firstly, the genuineness of a work can be established more easily. Secondly, the previous owner may add (or subtract) value to a work of art. It has been shown by psychologists and sociologists, that a prominent seller or previous owner can increase (or decrease) the value attributed by potential future owners (Joy & Sherry, 2010; D'Souza & Prentice, 2002; Pardo- Guerra, 2011; Marinelli & Palomba, 2011).

At the same time, over and underestimation beyond the window boundaries can be observed at most auctions undermining the perceived and promoted high level of expertise. Often, severe overestimation leads to no-sales or buy-ins (Ashenfelter, 1989; Ashenfelter & Graddy, 2011). Since the mid-eighties, auctioneers in New York have been required by law to publicly announce during the auction if an item was not sold, even though bidding took place, this being due to the secret reserve price not being met (Ashenfelter & Graddy, 2011)[9]. Although these statements are made during the auction, only an attentive listener will be able

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[9] The reserve price is estimated to be set at 60 – 80% of the low estimate (Mei & Moses, 2005). Mc Andrew and Thompson (2008) on the other hand state, that Christie's advises between 70 – 80 % of the low estimate, whereas Sotheby's advises between 50% - 100%. Auctioneers commonly refuse to comment on their reservation price policy, making the reserve price one of the best protected secrets within the auction circuit and topic of academic discourse (Hodges, 2012; Valsan & Sproule, 2008). For a discussion on the efficiency and reasoning behind the secrecy, see Ashenfelter (1989).

to notice the quiet announcement of "passed". Au contraire, auctioneers enthusiastically publish lot's that fetched a record price, either exceeding the high estimate or being close to the upper boundary of the window.[10] In any case, both under and over estimation can give a negative signal with regards to the auctioneers expertise and economists as well as cultural economists concerned with price formation, art market features and the role of expert opinion have been anxious to identify strategic estimation behavior and systematic bias. Accordingly, an extensive body of literature exists.

3.2.1. Underestimation

Valsan and Sproule (2008), in accordance with D'Souza and Prentice (2002), Louargand and McDaniel (1991), Ashenfelter and Graddy (2011) and Mei and Moses (2005), propose that underestimation attracts bidders and encourages competition. A low estimate can also influence the reserve price perception of the sellers, luring them into agreeing into a lower reserve which in turn attracts more buyers (Valsan & Sproule, 2008). At the same time, the seller's private reserve price can both be a value signal and have an influence on the estimates leading to a scenario, where the estimates do not reflect the expert's opinion but rather the seller's valuation (Beggs & Graddy, 1997; Mc Andrew & Thompson, 2008). A prestigious work of art will allow for the auctioneer to compromise and take more risk in order to consign the work. Underestimation can also lead to pleasant surprises for the seller, who receives a higher sale price and is more likely to consign with the same auctioneer again (Valsan & Sproule, 2008). Underestimation can appear to be a sign of conservatism and caution, hence wisdom, and in turn leading to more cliental (Valsan & Sproule, 2008). Moreover, underestimation can result in positive press and *unexpected* records, adding to the reputation and the public perception of respective auctioneer.

Beyond speculation on strategy deliberations[11], a number of studies have found systematic underestimation. Bauwens and Ginsburgh (2000) found that expensive English silver tends to be underestimated at Sotheby's and Christie's generally underestimates.[12] D'Souza and Prentice (2002) found underestimation in an auction of 159 Australian and European paintings by means of regressing the realized price against the midpoint of the estimation window. Using the same method, Chanel et al (1996) found underestimation in

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[10] For example, Picasso's 'Nude, Green Leaves and Bust' was estimated at around $ 80 million and sold for $106.5 million (including buyer's premium) at Christie's NY the 4th of May 2010 http://www.nytimes.com/2010/05/05/arts/design/05auction.html?_r=0

[11] For a comprehensive overview of strategies employed by auctioneers to foster price escalation see Herrero, M. (2010). Auctions, rituals and emotions in the art market.

[12] Silver as well as jewelry can be classified as collectibles with utilitarian features and is therefore different from art (Mc Andrew & Thompson, 2008). Nevertheless, both Bouwens and Ginsburgh's (2000) and Chanel et al. (1996) results are frequently referred to within the debate.

jewelry auctions. Beggs and Graddy (1997) obtained a similar result using a data set of 12,057 Impressionist paintings.

3.2.2. Overestimation

At the same time Beggs and Graddy (1997) found overestimation in a data set of 3,447 Contemporary art works auctioned at Christie's London. Bauwens and Ginsburgh (2000) detected overestimation for inexpensive silver sold at Sotheby's between 1976 and 1991. Mei and Moses (2005) detected overestimation in a data set with 6,114 observations of Old Master. Although underestimation is to be observed for lower priced items, overestimation is to be reported for high-priced items between 1973 and 2002. The authors draw the conclusion that the auction houses manage to balance over and underestimation. At the same time, more profitable, hence more expensive works tended to be overestimated. According to Mei and Moses (2005) this is to be ascribed to auction houses intentionally inflating their estimates on supposedly secure investments such as Masterpieces to increase commissions. Ekelund et al. (1998) conducted a study, among other aspects, on bias in Latin American art auctions sold at Christie's and Sotheby's over the period of 1977 to 1996. They found a 2.7% upward bias for oil-on-canvas' over this twenty year period.

Strategic reasons for overestimating have been theorized upon by most scholars involved in the debate. Firstly, high estimates attract sellers to consign with respective auctioneer and a high estimate will influence the seller to consign with one auctioneer rather than the other (Valsan & Sproule, 2008; Pardo-Guerra, 2011). Second, the auctioneer's commission is proportional to the final sales price; hence they have an interest to realize preferably high prices which are believed to be fetched through overestimation (Mei & Moses, 2005; Valsan & Sproule, 2008).

3.2.3 Unbiased Estimates

Milgrom and Weber's (1982) remark with regards to auction theory and bidding behavior, that honesty is the best policy for an auctioneer, which is widely accepted and often referred to when discussing the incentives of providing truthful estimates (Ekelund et al., 1998; Valsan & Sproule 2008, Beggs and Graddy, 1997; Bouwens & Ginsburgh, 2002; Mei & Moses, 2005; Ashenfelter, 1989). Economic theory on the one hand and common sense on the other seem to prove this policy right. As economic agents, auction houses reduce information asymmetries towards their clients by considering all possible factors for establishing value and proclaim themselves capable of such (Valsan & Sproule 2008). Moreover, rational learning should enable auctioneers to provide unbiased estimates in the long run to remain compatible (Mei & Moses, 2005; Valsan & Sproule 2008). The

competition between auctioneers, especially between Sotheby's and Christie's should further yield truthful estimates (D'Souza & Prentice, 2002). In general, although strategic under and overestimation can serve to attract buyers and sellers respectively, these effects nullify one another making all parties better of when truthful estimates are the standard (Valsan & Sproule 2008).

In accordance with this, a number of studies have found evidence for unbiased estimates. Among others, Ashenfelter (1989) concludes, that the estimates of the Impressionists under study were good predictors of the final price. Similar results have been reported by Czujak and Martins (2004) for Picasso works sold at the two top tier auction houses and for Americana sold at Sotheby's by Louargand and McDaniel (1991).

A major limitation onto the validity of the results on bias studies is that by nature, the analyses exclude un-sold items. Although there is no general rule to be observed, no-sales rates of up to 40% are can be observed, depending on type, segment, location, the economic situation, among other factors (Ashenfelter & Graddy, 2011).[13] Logically, results should show severe overestimation over all segments and auctioneers if the data sets where not truncated (Mei & Moses, 2005; Ashenfelter, 1989; Mc Andrew & Thompson, 2008).

3.3. "There's no item of value our experts cannot value" (Auctionata)[14]

Auctionata is a German based online auctioneer operating since 2012 and was initially auctioning every Friday live from their own TV - studio in Berlin.[15] The auctions are designed according to the English auction system and carried out by licensed auctioneers. Thematically, Auctionata is focusing on art, antiques and collectibles and curates its weekly auctions with mixed or specific themes. Passed lots and other items can be purchased at any time via the websites shop for fixed prices or via negotiations. Further, Auctionata offers a 25 year authenticity certificate for every item on sale. This guarantee suggests confidence by the auctioneer to have the necessary expertise to judge genuineness. This practice is in line with what Krugman and Wells (2008) identify as a main technique to reduce uncertainty in markets of lemons.

The start-up is rapidly expanding and recently opened a second full office including a studio in New York City and is planning to start auctioning over the course of 2014.

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[13] Ashenfelter (1989) for example reports 26% to 44% un-sold items for his auction results under observations, Beggs and Graddy (1997) observe 22% and 29%, Ashenfelter and Graddy (2011) between 43% and 11%, Ekelund et al (1998) 32% and Mc Andrew and Thompson (2008) 30%.
[14] http://auctionata.com/en/about-us
[15] In the period of interest for our research, Auctionata has been auctioning only on Friday's. Since March 2014 their auction calendar is more divers.

Auctionata offers a free valuation service for up to five items per consignor. Based on and interview with S. Srega, the Valuations Account and Consignor Director, that we conducted earlier this year at Auctionata's head office, the valuation process is being presented in the following (Interview : Appendix A).

In-house skimmers make a pre-selection of items that have been sent for valuation based on an initial estimation of the value: " […] there are price limits and below a certain value, the costs for logistic, storage and production are too high." (Srega, 2014). However, for items that do not fulfill the in-house minimum value within the respective category but are produced by a famous artist exceptions are being made. Subsequently, the skimmers allot potential auction items to respective departments where it is decided whether to take the item into their catalogues or not.[16] Items that are not of interest for an auction can be sold via the Auctionata shop upon interest by the consignor.

The actual estimation process at Auctionata is not bound to fixed guidelines comparable to Christie's or Sotheby's. Rather, the items are being processed by the departments which consign freelance experts to carry out valuation and estimation. Auctionata's expert network is composed of approximately 250 specialists, with expertness ranging from collectibles to fine arts and antiques. Databases for comparable items and previous sales prices are considered, but the quality is the main factor according to Srega (2014). No specific rules exist on how many specialists are being consulted, but if opinions on the value happen to vary greatly, the final decision is made by the department specialist.

Within the estimation process two extra deliberations are being taken into account. Firstly, the estimation price, and hence the starting price which is half of the estimate, can be revised downwards to attract more bidders. Secondly, the sellers own reserve price can influence the estimate. In situations, were Auctionata is confident about exceeding the sellers reserve, they are offered a payment guarantee. Yet, only five of 100 items are having secret reserves in the first place and it is in the interest of Auctionata to keep this figure as small as possible for leeway and unbiased estimation.

Srega (2014) emphasized that for the consignors, there are different levels of expectations about the estimates. Most of the consignors are amateurs who have no knowledge of the worth of their items and they are indifferent to the final price, as they had

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[16] Since February 2014 above described selection process has changed due to reorganization of the internal structures. Therefore the interview in Appendix A does not reflect the status quo. Consultation with S. Srega, M . Exel and S . v. Wedel via personal communication (May 20/21, 2014) complimented and specified the information given in the interview.

not expected to possess a valuable item in the first place. Collectors, or semi-amateurs, deaccessioning on the other hand do have a general idea of the value and are eager for item to reach or exceed the estimate. We suppose that the latter are among the consignors that have the bargaining power to ask for a fixed secret reserve. Finally, dealers consigning with Auctionata insist on reserve prices in most cases. This behavior is in line with posted prices in galleries/shops where a broader audience can be reached and bad sellers sold via a different sales channel.

3.4. Summary

As shown above, previous studies of estimates produced ambiguous results including systematic over- and underestimation as well as unbiased estimates. At the same time, it is widely accepted that an auctioneer should, to the best of his knowledge, provide truthful estimates. Valsan and Sproule (2008) point out, that the practice of setting secret reserves can have great influence on the estimation window, depending on the seller's price notion and his bargaining power, and therewith on the final price. Hence, the expert opinion and evaluation on an item can be influenced by a force that is not connected to the market conditions but by private value. The same holds true to some extend for estimates at Auctionata. Yet, the practice of estimating prices, although born from revenue considerations, suggest authority, market knowledge and confidence in the own capabilities.

IV. Methodology

4.1. Introduction

Academic research has mainly focused on regression analyses to determine degrees of bias and to describe and identify significant factors. The samples in earlier studies have mostly been derived from catalogues of the top-tier auctioneers Sotheby's and Christies. In contrast, this study is making use of a data set from online auctioneer Auctionata while employing similar methods. This will allow drawing conclusions for a new market space within the art market while it will add to the existing canon. The first section of this chapter is concerned with the data collection procedure and the variables available for the analysis. Further, the research design is presented, discussing both analyses of the whole sample and of a sub-sample, namely paintings.

4.2. The Data

The sample was derived from Auctionata directly, who offered to provide this research with the relevant data.[17] Selecting the sample was bound to two restrictions. First, the company has been operational for approximately one year by the time the topic of this research was set. Hence, the time frame of the sales records was set to a one year period (12/2012 – 12/2013). Second, the company does auction items with variety of themes including, among others, wines, antique toys, vintage clothing and watches. By means of selecting only art related auctions for the analysis, 18 auctions were selected. In chronological order of time, the auctions composing the data set are shown in Table 1. The sample consists of 1663 valid observations. [18] The 1017 items that have been sold, equaling an average of 61% sales, will be the unit analyze as unsold items, by nature failed to reach their estimated prices and are therefore not to be regarded (Mei & Moses, 2005).

Each case in the sample came with a set of information, allowing the construction of variables and the computation of two continuous variables expressing bias in percentage and monetary terms (Table 2). A variable expressing the bias in percentage terms with a base-10 logarithmic transformation has also been added. The constant 77 was added to correct for negative numbers and turn the smallest value, -75%, into a value greater than 0 (Field, 2009). The respective constant in monetary terms has been added to the bias expressed in monetary

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[17] The data set is reproducible by making use of information provided on past auction results on Auctionata's website http://www.auctionata.com

[18] A cross comparison to the results published online revealed that 31 cases are missing from the data set. According to Auctionata, the cases are missing from the set due to internal errors but are to be regarded as unsold items (M. Schruth, personal communication, January 28, 2014).

terms to compute the log of these values. Furthermore, the log of the starting price has also been computed in order to adjust the level of measurement for the analysis.

TABLE 1

Overview of auctions in the data set

Auction Nr.	Auction Title	Lots	Sold	Ratio
1	The First Auction in the History of the Internet	79	57	72%
8	Asian Art	94	72	77%
9	Paintings, Works on Paper and Sculptures	93	68	73%
11	Paintings from the Estate of a Berlin Collector	50	27	54%
15	Modern and Contemporary Art	75	38	51%
16	Antiques From Asia and Europe	75	47	63%
17	Graphic Art from Three Centuries	75	61	81%
18	Paintings and Works on Paper	75	37	49%
19	Paintings from the Estate of a Berlin Collector, Part Two	75	56	75%
21	Asian Antiques	74	47	64%
22	Art: Classic and Modern	80	41	51%
25	Three Centuries of Tibetan Art	120	68	57%
26	Asian Art from China, Japan and Southeast Asia	120	93	78%
27	Works of Art, Rarities and Collectibles	120	53	44%
28	Ancient Egyptian Art from two Important Collections	92	30	33%
31	Asian Works of Art	120	86	72%
32	Fine Arts	124	85	69%
33	Modern Art & Photography	120	51	43%
18		1663	1017	61%

The transformation has been necessary due to outliers and values of skeweness and kurtosis suggesting a non-normal distribution. Following Field (2009), the sample was inspected for human error, but none could be detected. Moreover, it is a common phenomenon in the cultural sector, for example in box office revenues, that extreme outliers skew data (Walls, 2005). Item in auctions, price escalation and extreme cases of underperformance are no rarity. Therefore, the outliers could not be removed from the sample, but the log transformation reduced the positive skew and the distribution moved closer to being normal. The same transformation with the constant 73 was performed on the subsample.

The values of the log transformation are not in their original units of measurement anymore after the transformation. They by themselves are inconclusive. Therefore, the log-values have been transformed into their respective geometric means.

$$x = \log_b{}^{-1}(y) = b^{\,y}$$

The geometric means in turn are not as affected by the large values in our skewed distribution that are likely to pull the arithmetic mean, but represents the / a 'truer' estimation of the population mean (Oliver et al., 2008).

TABLE 2

Overview and description of variables

Given	Description
Auction Number	The Number of the individual Auction as published online, chronological by date
Catalogue Number	Position of a lot within the auction = Lot number
Starting Price	Starting price in Euro
Estimated Value	Estimated value as per pre-auction catalogue publication
Winning Bid	Hammer price
Bidders per Lot	Amount of bidders per lot
Bidders per Auction	The total amount of participants of an auction
Added	
Bias in %	Ratio between estimated value and Winning bid in percentage
Bias in €	Ratio between estimated value and Winning bid in Euro
Log Bias in %	Log10 transformed values of the bias in percentage
Log Bias in €	Log10 transformed values of the bias in Euro
Log Starting Price	Log10 transformed values of the starting price

4.3. Methods I

The first part of the analysis aims to answer the research question, if estimates provided by Auctionata are unbiased. In previous research, unbiasedness has been set equal to a zero percent difference between the estimated value and the winning bid (Hodges, 2012; Dass & Ready, 2008). Beyond calculating this value, a simple regression analysis was conducted to accept or reject the null hypothesis of unbiasedness. Following Chanel et al (1996) and D'Souza and Prentice (2002) the winning bid was regressed against the estimated

price P^e. Rejection of the null hypothesis requires the coefficient of P^e to be different from one, whereas acceptance requires the coefficient to be one (D'Souza & Prentice, 2002).

In contrast to previous research on paintings, items sold at Auctionata do not solicit to make statements on specific art history related styles, such as impressionist paintings or old masters. Respective samples would be too small at this point in time to derive statistically significant results. Therefore, unbiasedness was tested for a subsample containing only the paintings within the sample (N = 335). [19]

A first overview of the data as presented in Table 3 reveals that the starting price range of items auctioned at Auctionata starts as low as €30 and ranges till €60.000, classifying the auctioneer as a participant of the lower and middle segment of the secondary market (Mc Andrew, 2014).[20] A closer look on the median and mode informs that although the mean starting price is €2694. The most frequent starting price is at €500. In terms of winning bids, a similar observation is to be made. Although the mean suggests an average winning bid price range exceeding €5000, the median and mode relativize these findings. Moreover, the mean and median values of the estimated prices indicate overestimation in comparison to the winning bid, whereas the mode suggests underestimation.

TABLE 3

Descriptive statistics of the data set (N = 1017)

	Starting Bid	Estimated Value	Winning Bid	Bidders/ auction	Bidders/ lot
Minimum	30	60	30	44	1
Maximum	1000000	2000000	1500000	321	18
Mean	2694.77	5450.4	5087.8	163.65	2.4
Median	500	1000	800	141	2
Mode	500	300[a]	1200	321	1
Std. Deviation	32095.636	64197.837	49651.332	84.148	1.921
Skewness	29.774	29.763	27.373	0.407	2.45
Std. Error of Skewness	.077	.077	.077	.077	.077
Kurtosis	920.941	920.45	813.015	-1.081	8.925
Std. Error of Kurtosis	.153	.153	.153	.153	.153

a. Multiple modes exist. The smallest value is shown

[19] Included in the sample are items that have been classified in the catalogue with one of the following descriptions: painting, gouache, watercolor, acrylic, pastel, tempera or ink.

[20] With two exceptions, Egon Schiele's *Reclining Woman* (starting price €1.000.000) and Vincent van Gogh's *The Plain of La Crau* (starting price €180.000).

It is also to be emphasized that although on average 164 bidders have registered per auction, an average of 2 bidders participated in bidding per lot whereas the mode value is only 1 bidder per lot.

Beyond testing for unbiasedness, it is of interest and in line with previous research to detect possible differences of bias with regards to specific characteristics of the item sold. The ten items within the data set with the highest bias were lots of Asian origin. This led to the assumption that the level of bias differs depending on the origin. The assumption was first tested by means of a correlation matrix to make observations on a possible correlation between origin and bias. The results were followed up with a regression analysis.

We were further interested to analyze if the starting price of an item has an effect on the precision of the estimate. Therefore, we conducted a regression analysis using the log of the bias expressed in Euro and the starting bid as an expression of the price segment. For the analysis the log transformed values have been used to control for non-normality.

4.4. Methods II

TABLE 4
Descriptive statistics of the subsample paintings (N = 335)

	Starting Bid	Estimate Value	Winning Bid	Bidders/ auction	Bidders/ lot
Minimum	90	180	100	44	1
Maximum	1000000	2000000	1500000	321	18
Mean	4956	9969.28	8895.01	153.03	2.4
Median	600	1200	900	126	2
Mode	150[a]	3000	150[a]	266	1
Std. Deviation	54836.8	109680	83724.3	83.333	1.882
Skewness	18.002	17.998	17.111	0.414	3.124
Std. Error of Skewness	.133	.133	.133	.133	.133
Kurtosis	327.452	327.339	303.896	-1.232	16.793
Std. Error of Kurtosis	.266	.266	.266	.266	.266

a. Multiple modes exist. The smallest value is shown

In a second analysis, the sub-sample paintings was analyzed more in depth. The descriptive statistics of the subsample presented in Table 4 reveal that the minimum starting bid for paintings was at € 90 and the highest at €1.000.0000. This figure appears in

both sample and subsample, as it is above mentioned Schiele watercolor that classifies as a painting according to our definition. The mean starting price is €4956.00, but the median € 600. Hence, paintings by themselves are valued slightly higher than items in the sample as whole. Similar to the entire sample, mean and median of the estimated value indicate overestimation and the mode underestimation.

The average amount of bidders is lower than for the sample as a whole with 153 bidders, whereas the amount per lot is the same with 2.4 on average but a mode value of 1.

TABLE 5
Overview of explanatory variables regarded in the analysis of the subsample

	Definition	N
Area*	Area in cm	335
Canvas	D = 1 if canvas, 0 otherwise	167
Oil	D = 1 if oil , 0 otherwise	221
Gouache	D = 1 if Gouache, 0 otherwise	10
Watercolor	D = 1 if watercolor , 0 otherwise	22
Mixed Media	D = 1 if mixed media , 0 otherwise	56
Signed**	D = 1 if signed , 0 otherwise	283
Dead	D = 1 if dead, 0 otherwise	294
Age***	Age of the painting, 0 otherwise	335
Number	Lot Number	335
Provenance	D = 1 if known provenance, 0 otherwise	213
Reference	D = 1 if reference to previous auction results, 0 otherwise	198
Featured	D = 1 if featured in catalogue write-up, 0 otherwise	17
Title	D = 1 if on the Title page, 0 otherwise	6

* No consistency in the catalogue. In some cases, only the framed size was stated.
** "Attributed" paintings have been excluded.
*** When age was unknown, the midpoint between birth and death year was used. When the creation date was approximated within one decade, the midpoint has been used as well.

We aimed to detect possible variables that influence the level of bias. The properties regarded in the analysis are based on the information provided by Auctionata's pre-sales catalogues. An overview of the variables is presented in Table 5. The catalogue includes information on size, support and medium, properties that are often regarded in similar analysis. Among other aspects, it has been suggested, that size, provenance and signature have a positive effect on pricing and so does oil and the fact that the creator is deceased (Marinelli & Palomba, 2011). We suppose that the information provided in the catalogue is

equitable to the information available to the estimator's. In turn it is also the information made available to all potential buyers to base their reserve prices upon (Mei & Moses, 2005).

The variables chosen for the analysis are both continuous and categorical. A multiple regression analysis with a general linear model was used to examine the effects of the characteristics on the bias (Taylor, 2002). This method has been favored over a regular multiple regression analysis, as one can conduct one analysis with all variables rather than a number of regressions with respective groups.

4. 5. Methods III

Finally, as discussed chapter three, scholars assume for auctioneers to improve their estimations over time. Although the sample has been collected over a one year period only, this assumption was tested graphically incorporating both arithmetic and geometric mean per auction.

4.6. Tools

The samples have been analyzed with IBM SPSS Statistics 19.00 and Microsoft Excel in the exploration phase of the research.

V. Results

5.1. Introduction

We discuss the results of the analyses in the following manner. First, the results of the tests for unbiasedness are being reported. Further, the relation between origin and bias is being discussed. We proceed with observations on the subsample in terms of characteristics possibly influencing bias. Additionally, we discuss the arithmetic and geometric mean bias over time and conclude with the limitation of the analyses.

5.2. Test for Bias

The results of the simple regression analysis to accept or reject the null hypothesis of unbiasedness, where the winning bid is dependent and the estimated price independent variable are the following. The prediction power of the regression model is satisfactory with $R^2 = .972$ ($F = 35173.86$, $p < .001$). However, the coefficient is not equal to one and therefore the null hypothesis, unbiasedness, is to be rejected (Table 6).

Zero or first order correlation is also to be rejected as for the result of the Durbin-Watson test. As the value of P^e is below one, overestimation is to be assumed.[21]

The result of the regression analysis including only the winning price and estimated price of paintings with $R^2 = .979$ is similar. The coefficient is not equal to one ($F = 15195.41$, $p < .001$), hence unbiasedness is to be rejected.

TABLE 6

Result of the tests for unbiasedness

Data			Paintings		
	b	Std. Error		*b*	Std. Error
Constant	931.93**	261.813	Constant	1366.98**	673.645
P^e	0.762**	0.004	P^e	0.755*	0.006
Durbin-Watson:	1.971		Durbin-Watson:	0.235	

*Sig. at $p < .05$
** Sig. at $p < .001$

The variance of P^e to one is relatively big, suggesting a considerable difference between estimate and winning bid. At the same time, the result of the Durbin Watson test

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[21] The H0 $b_1 = 1$ can also be rejected when using the t-test rather than when following D'Souza and Prentice

indicates positive autocorrelation; therefore the model is not generalizable beyond the sample itself (Field, 2009).

The descriptive statistics concerning bias in percentage and in Euro terms for the data and the sub-ample reported in Table 7 reconfirm these findings. The mean bias measured in percentages, -1.08%, indicates for a small negative average variance between estimated value and winning bid for the sample as a whole. However, the standard deviation and value of the median and mode indicate that there are great differences between cases. Further, the division into quartiles reveals, that the vast majority of cases was overestimated, but that extreme outliers influenced the average to an extend that estimates seem very close to being unbiased. Calculating the geometric mean of the bias reveals a rather different trend, namely an upward bias of 30.2%.

The descriptive statistics of the subsample suggest severer overestimation for paintings with 7.35%. Again, the majority of cases have been overestimated. This trend is more accurately reflected when calculating the geometric mean of the bias (-32.07%).

TABLE 7
Descriptive statistics of bias

Data				Paintings	
		Bias %	Bias €	Bias %	Bias €
N	Valid	1017	1017	335	335
	Missing	0	0	0	0
Mean		-1.08%	-362.61	-7.35%	-1074.3
Median		-40%	-200	-40%	-220
Mode		-50%	-200[a]	-50%	0
Std. Deviation		213.23%	17367.7	177.05%	29524.3
Percentiles	25	-50%	-750	-50%	-800
	50	-40%	-200	-40%	-220
	75	-8.33%	-30	-12.50%	-60

a. Multiple modes exist. The smallest value is shown

5.3. Origin

A closer look at the outliers of the sample revealed that the ten most extreme cases of underestimation are lots of Asian origin. As presented in Table 9 arithmetic and geometric means vary across the 431 Asian art works, 541 European and 45 art works of other origins.

By means of a correlation matrix, the significance of the different origins to the bias could be observed before proceeding to the regression analysis. Asian art has weak significant positive correlation to the bias ($r = .188$, $p < .001$) , whereas art with European origin has a

weak significant negative correlation ($r = -.161$, $p <.001$) . Art from other origins is not significantly correlated to the level of bias and were therefore not regarded in the regression analysis ($F = 18.99$, $p <.001$)

3.6% ($p <.001$)of the bias can be explained by the origin, but these findings cannot be generalized ($d = 0.49$). Asian art has a significantly positive influence on the level of bias at $p <.05$ (Table 8), whereas European origin has no significant effect.

TABLE 8

Results multiple regression of origin on the level of bias

	b	Std. Error
(Constant)	1.578**	0.048
Asian	.165*	0.051
European	0.044	0.05

* Sig. at $p < .05$
**Sig. at $p < .001$

As the regression was performed using the log, the values have to be translated into their original unit of measurement by means of calculating the antilog to interpret them.

$$x = \log_b{}^{-1}(y) = b^{\,y} \; -> \log_{10}{}^{-1}(1.578+ .165) = 55.34\% \text{ - } 77 = \text{-}21.7 \text{ \%}$$

Therefore, lots of Asian origin have a geometric mean upward bias of 21.7%, 8.4% lower than the geometric mean of the sample as a whole, 13.5% lower than works of European Origin and 17.5% lower than works of other origins.

TABLE 9

Arithmetic and Geometric mean bias of origin categories

	N	Arithmetic mean	Geometric mean
Sample	1017	-1.08%	-30.12%
Asian	432	30.23%	-21.70%
European	540	-23.60%	-35.20%
Other Origins	45	-31.70%	-39.20%

5.4. Price Segments

The results of the regression analysis ($F = 33.43$, $p <.001$) with the log of the bias expressed in euro as dependent variable and the log of the starting bid as independent variable

were the following. 3.2% ($p < .001$) of the level of bias can be explained by the starting price. A significant weak negative correlation ($r = -.179$, $p < .001$) can be observed. The effect of the correlation is significant at p<.001indicating that the higher the starting bid, the lower the bias (Table 10). With every increase of the starting bid by €1 the upward bias is reduced by €1.12 as $log_{10}^{-1}(.05) = €1.12$.

TABLE 10
Result regression Analysis of the impact of the starting price on bias

	b	Std. Error
(Constant)	5.833**	0.024
Starting Price	-.05**	0.009

** Sig. at $p < .001$

5.5. Paintings

By means of composing a correlation matrix three significant observations can be reported. At $p <.001$items of mixed media are have a weak positive correlation ($r = .167$) to the level of bias, so do items with indicated provenance ($r = .150$) and the catalogue number ($r = .155$). In order to confirm or refute these observations, a regression analysis including all characteristics was conducted.

The results of the multiple regression with a General Linear Model ($R^2 = .094$, $F = 2.55$, $p < .05$) are reported in Table 11. For the variables provenance, dead and catalogue number the following significant results could be obtained. All other variables held constant, paintings where the provenance was indicated in the catalogue (provenance = 1) had on average a significant lower level of bias than paintings without indicated provenance ($b = .090$; $p <.05$). Back transformed into percentage values, paintings with indicated provenance had a 5.6 % lower level of bias than paintings without provenance.[22] Paintings from deceased artists (dead = 1) also had positive influence on the level of bias, all other variables held constant ($b = .143$, $p <.05$).[23] Expressed in percentage terms, the bias was 9.5 % lower. The order within the catalogue does also have a significant effect on the level of bias ($b = .001$, $p <.05$.). Although the difference in percentages seems marginal (0.08%), the effect is significant and can pile up to a total of 8% in an auction with 120 lots.[24]

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[22] $log_{10}^{-1}(1.386 + .090) - 73 = - 43.08\%$
[23] $log_{10}^{-1}(1.386 + .143) - 73 = - 39.2 \%$
[24] $log_{10}^{-1}(1.386 + .001) - 73 = - 48.6\%$

TABLE 11

Coefficients of painting characteristics on the bias in %

	b	Std. Error
Intercept	1.386	.098
Area	0.000004258	0.000003166
Canvas	.022	.049
Oil	-.062	.077
Gouache	-.136	.122
Watercolor	-.009	.096
Mixed Media	.110	.076
Signed	-.060	.058
Dead	.143*	.066
Age	.000	.000
Catalog Number	.001*	.001
Provenance	.090*	.039
Reference to other auctions	.001	.039
Featured	.097	.082
Titel	.074	.134

* Sig. at *p*<.05

5.6. Performance over time

FIGURE 1

Arithmetic and geometric mean bias over one year (12/2012 – 12/2013)
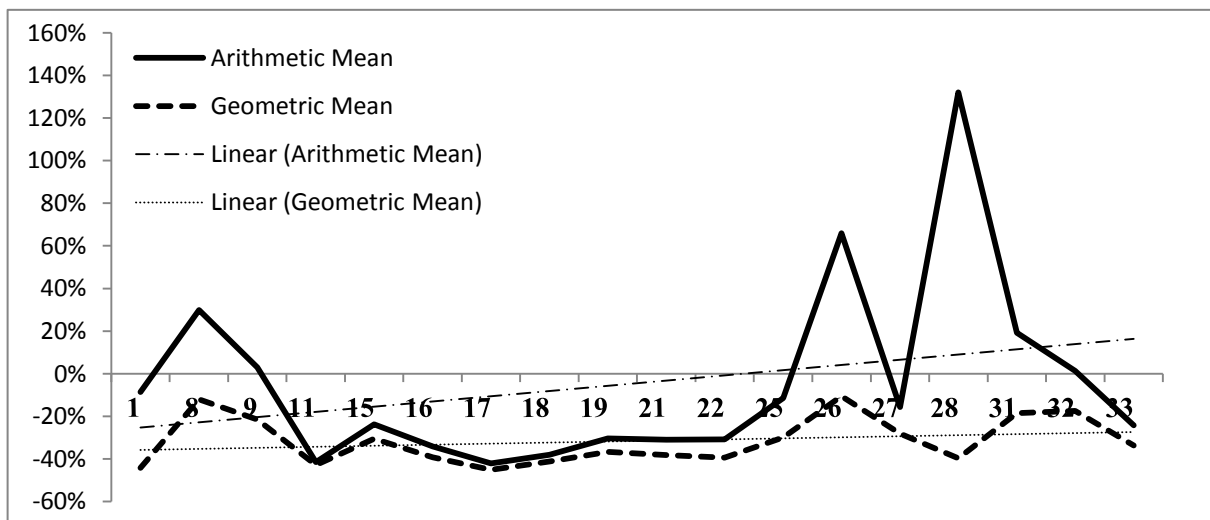
From the visual in Figure 1, we can conclude that when considering the selected auctions, only slight improvement can be reported. All three peeks are Asian themes auctions, namely 8, 26 and 31 (c.f. Table 1) .

Here, the focus should be turned to the geometric mean as the true representative of the precision of the estimates. The geometric mean indicates overestimation throughout all auctions in the sample.

VI. Interpretation

First and foremost, Auctionata's estimates are not unbiased. Although we discussed that honesty would be the best policy, which implies unbiased estimates, the results of our analysis suggest systematic upward bias. At the same time, it would be perceptive to conclude that Auctionata is not being honest. On the other hand, it might be that both internal valuation system and expert expertise have not fully developed or matured yet, which leads to false estimates. Additionally, the rather small amount of bidders per item as described in section 4.3. and 4.4. suggests that not all potential clients had received notification of the auctions. Nonetheless auction theory strongly emphasizes on the importance of "the number and quality of bidders" (Sagot-Duvauroux, 2011, p.46). Consequently, competitive bidding cannot take place and the single bidders win at the starting price, which is 50% of the estimation as per company policy. Ergo, 50% overestimation is automatically to be observed. Despite the small amount of bidders, the current market value is revealed, undermining the level of expertise the auctioneer presumably holds (Ashenfelter, 1989). Therefore, estimates should be scaled down in order to attract more bidders, while strategies on international visibility should be intensified. To what extend reserve prices have influenced the estimates we do not know, but considering that reserves are not the norm at Auctionata, their influence should be small. Overestimating to attract consignments on the other hand as suggested by Valsan and Sproule (2008) might have occurred, thereby leading the observed upward bias.

Our results do suggest differences in the level of bias with regards to the origin and the starting price of an artwork. Asian art has a significantly smaller mean bias hinting towards two aspects. Firstly, this could be interpreted in favor of the experts estimating Asian art as they seem to be closer to being unbiased. At the same time, the ten art works in the data with the highest underestimation have been of Asian origin. It is likely that these ten cases truncate the results leading to a smaller average mean bias. Simultaneously, the extreme underestimation is not complimentary to the experts of Asian art. A second explanation of the mean differences would could the general increase of Chinese bidders at auctions, who involve in competitive bidding over their cultural heritage and the occurrence of winner's curses (Mc Andrew, 2012; Velthuis, 2011*a*).

Furthermore, we find the correlation of the level of bias and starting price remarkable, and suggestive of more expensive artwork having a lower bias. This can be explained by the idea that more information on comparable items and previous sale prices is accessible knowledge for both experts and audience. Additionally, this correlation also suggests that a

winner's curse is more likely to be observed when items have a higher starting price as opposed to items with a lower starting price.

The absence of a standardized estimation procedure might lead to the lack of precision, while Auctionatas expert network might not have the sufficient amount of expertise and experience. When solely considering the absence of all potential buyers and leaving the expertise question unchallenged, it can be assumed, that bargains can be acquired through the Auctionata auctions.

Concerning our results on variables influencing bias of paintings, the findings are partially consistent with previous findings and theoretical assumptions about value components of art works. Known provenance has a positive influence on the price and reduces the upward bias. We have further found that art works of deceased artists have an even stronger positive influence in reducing the upward bias. Both of these components can be interpreted as aspects which reduce uncertainty. Artworks with known provenance, especially when famous, are perceived of having higher value (Pardo-Guerra, 2011; Marinelli & Palomba, 2011). Further, the value of paintings from deceased artists are more or less established and less sensitive to fads and fashion than contemporary art is (Singer & Lynch, 1994; Marinelli & Palomba, 2011). Somewhat surprisingly we do not find evidence for the significance of the signature. Sagot-Duvauroux (2011) suggests it to be the most relevant property in pricing as it is equitable to guaranteed authenticity. In addition, our results are somewhat contradictory towards the findings on the importance of physical properties, i.e. media, material and techniques for the price (Sagot-Duvauroux, 2011). Although price was not our focus, we can state that the physical properties regarded have no influence on the estimate precision in our data set.

Interestingly, we find in our paintings sample that the upward bias decreases the further along the auctions is. A possible explanation could be that during the beginning of an auction bidders observe the bidding procedures first and then become more confident into participating as the auction is proceeds. It would be of great interest if this trend is observable in other auction houses as well.

Finally, our diagrammatic representation of the level of bias over time reveals only slight improvement. We assume that one explanation is that the rational learning process which Valsan and Sproule (2008), among others, hypothesized about is not completed yet.

VII. Conclusion

A number of limitations are to be mentioned with regards to interpreting the results. Although we assumed the data to be normally distributed in due consideration of the central limit theorem, the values of skeweness and kurtosis suggested a positively skewed distribution with heavy tails of the bias measured in percentage of the untransformed data (Appendix B). The results of a Kolmogorov-Smirnov test for normality confirmed these results. After the log transformation, the result of the Kolmogorov-Smirnov test continued to indicate non-normality (Appendix B). Accordingly, conclusions have to be drawn with care and generalization is limited due to the Durbin-Watson values. Furthermore, the results are based on data from one online auctioneer only and hold therefore only true for the specific auctioneer and data analyzed. Addtionally, the prediction power of our GLM was not satisfactorily high suggesting that some variables containing relevant information are omitted. Therefore we can not preclude that omitted-variable bias occurred (Field, 2009). We presume that content matter may be one of them (Pardo-Guerra, 2011). With regards to our analysis of paintings, the amount of cases per category has been partially too small to produce significant results. A data set with a bigger population would solve this issue. Last but not least, we have to re-emphasize the remark by Mei and Moses (2005) and Mc Andrew and Thompson (2008), which states that results would show severe overestimation over all segments and auctioneers when unsold items would be regarded in the analysis.

Throughout this paper we have discussed the difficulties of estimating the value of an artwork. We argued in line with Velthuis (2011*b*) that auctions are the best mechanism to establish the value of art. Furthermore, the practice of estimating the price of an artwork prior to an auction when nobody knows is a superior task which requires a great amount of expertise and is among the core tasks of an auctioneer (Ashenfleter & Graddy, 2011). However, previous research has produced ambiguous results for the actual level of bias, revealing cases of systematic over and underestimation as well as unbiasedness. We were able to show that in our data set overestimation is to be observed. From our data on paintings we were able to show the influence of the specific variables regarded. As our findings seem to both contradict and confirm previous research, avenues for future research on differences and similarities between on- and offline art auctions, price formation and estimates are manifold.

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Appendix A

Translated transcript of the Interview with Sarah Srega, Valuations Account and Consignor Relations Director,12th of February 2014.

Q1: How does the process from enquiry to final valuation work?

Once an enquiry is being send to us our inhouse skimmer select what is of interest for the company.
In case the item is not of interest, the supplier receives an estimation of the value and a letter of refuse [as advertised]. If an item is of interest, the information material is being sent to one of the external experts and an evaluation and estimation is being send to the supplier together with a contract for inspection.

Q 2: How is it being decided if an object is of interest?
It is very much dependent on the estimated value. Basically, there are price limits and below a certain value, the costs for logistic, storage and production are too high. Moreover, it depends very much on the artist if an item is of interest.

Q 3: So, it does occur that an estimate is rather low, but the artist is of general interest although it is an item low quality?
Yes. Printed graphics for example are not of that much value. But we do happen to have auctions with items with a lower average value. In those case we do take works into consignment of for example an estimated value of 800 euros, which below the price limit of what we usually consign.
That could be an item of a known artist but with a lower quality which is still sellable due to the artist.

Q 4: How do you decide whether to place items up for sale in the Auctionata shop or for an auction?
The curators decide. They compose the auctions according to a theme and select accordingly. Moreover, they select items that have the potential to attract bidders, hence price escalation. If it's a pretty painting with an unknown artist and low value we are likely to put it in the shop where it is also likely to find a buyer. The price of such a painting would not increase without a name.

Q 5: If you plan for an auction with printed graphics for example, you would present everything that was offered to you to the curator who than decides and composes the auction? Yes. The curator for the specific auction selects what is interesting and what is not.

Q 6: Is there an official method or guideline on how to produce estimates?
No. We do not have that. The external experts do the research themselves, looking at data bases and alike. Especially for known artists, there is always information you can relate to. Besides that, the quality is a main determinator.

Q 7: So there is no fixed method?
No, basically it depends on the condition, the quality, the epoch of creation and the artist. All factors combined influence the price but it depends on the work of art and is different for every single item.

Q 8: Is it possible to find comparable prices for unknown artists?
Yes.

Q 9: What kind of background do your sellers have?
The majority of the enquiry for estimation are from amateurs that do not know what their item is worth. The type of person who finds an item in its attic or in his grandparent's estate and makes use of our service to estimate free of charge in order to get an idea of the value. Also, there are collectors with expensive collections that have a firm idea of what their items are worth

Q10: Does that mean that your experts have access to information the amateur has not?
Yes. They have access to ArtPrice and alike and the estimation service at Auctionata is for free.

Q 11: What background do the experts have? Art historians? Collectors? Established experts?
Ask the experts people.

Q 12: If an item is being sent for estimation, that for example is estimated around 50.000, how many people were involved in the decision? Can the process be imagined as two experts giving different estimates (40.000 vs. 60.000) and it is than decided to take the average?

Not really. If we get two very different estimates, the estimation will be done in house again. Either by Susanne [Chief Production & Sales Officer] or by the curator of the auction. Especially with the high estimated items, internal experts have a final careful look and the final say.

Q 13: How much tactic involved? As in a Schiele cannot be offered below 1.000.000?
Of course a little tactic is involved. One once to be keen, as the cheaper you are the more bidders you attract and the higher the hammer price. Of course that plays a role [estimating demand], but in the end it naturally also depends on the sellers idea of the price.

Q 14: How much does the seller's expectation influence the estimate? If he is not an amateur and feels that he knows that a piece should be around 10.000 for example, how do you proceed?
Either a mutual agreement can be found or a lower price is being set but a reserve exceeding the starting bid offered with fixed payment. These types of guarantees are given if Auctionata feels confident to be selling the item at a price exceeding the reserve.

Q 15: So, you do have reserve prices?
Just with some objects.

Q 16: Are you 'allowed' to buy-in?
No.

Q17: We can therefore assume that the expectations of the seller are seldom around the estimate but rather around the start price, given that reserves are very rare?
No, around the estimate. As the start price is half of the estimate.

Q18: How come the start price is half the estimate?
I don't know. Company philosophy. But it is great way to see how the market really values a piece of art, as we do not know 100% before. The buyers decide the price – self regulation.

Q 19: It seems very risky to start at 50% of the estimate.
The market value is shown with the amount of bidders and their bidding behavior. If there are not many bid's than it seems that the market value must be lower. But this could be very different in a year's time as taste and demand can change. A certain risk of course is there.

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Q 20: The seller does sign that the starting price is 50% of the estimate and that he will get whatever the final bid is, right?

It is always different. Sometimes the limit is at the estimate; sometimes in between it is a matter of negotiation.

Q 21: Do you charge the seller if an item goes unsold?

No, no premiums are being charged if an item goes unsold.

Q 22: How important do you think it is that estimates are being met?

For the customer it is very important that the estimates are reached or the final bid is higher. But for customers that were not aware of the value it is indifferent, they are usually happy when they get the starting price. Then again, it really depends on the customer.

Q 23: How many enquiry's do you get per week?

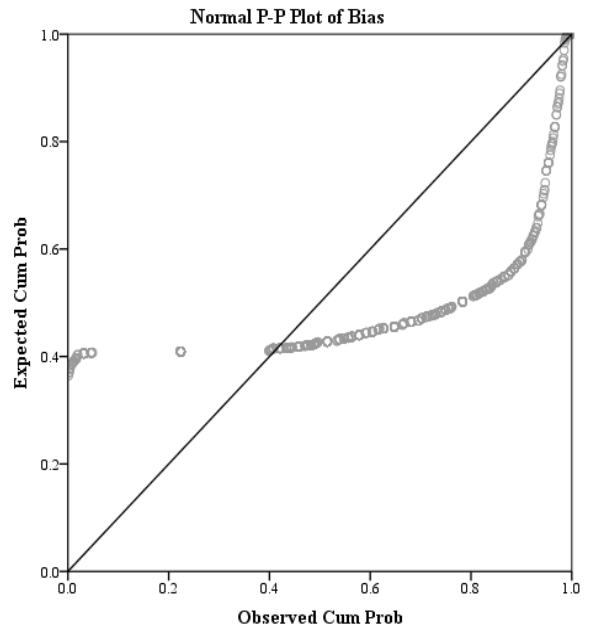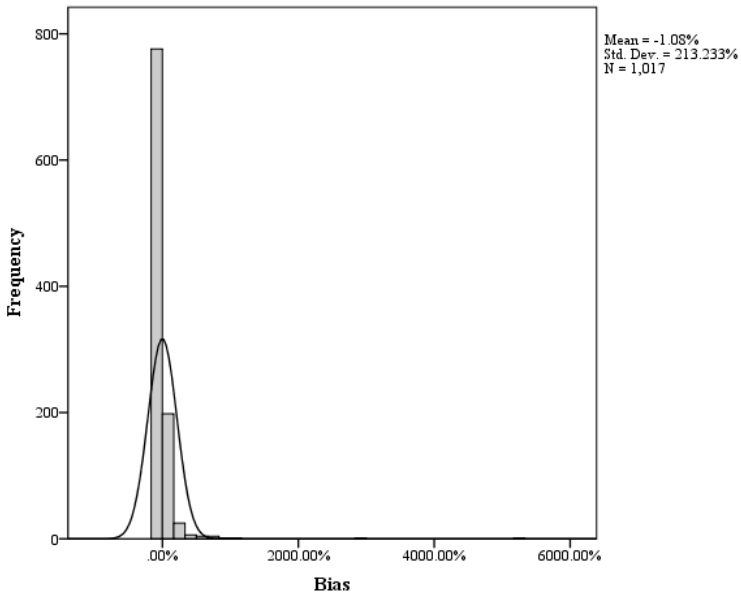Around 1000 per week. 80% is not of interest, 20% is being processed further.

Appendix B

Test of Normality for the variable bias measured in percentage

Skeweness: 17.64, SE = .077

Kurtosis : 392.52, SE = .153

Kolmogorov-Smirnov Test: $D = .38$ $p < .05$.

Test of Normality for the log-transformed variable bias measured in percentage

Skeweness: 1.53, SE = .077

Kurtosis : 4.166, SE = .153

Kolmogorov-Smirnov Test: $D = .19$ $p < .05$.