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Introduction

Art objects have been traded from at least as far as the time of the Roman Empire, as evidenced by the discoveries of remnants of ships laden with Greek sculptures close to Italy's coastline (Chanel et al. 1994). Since the end of World War II, buying and selling art has become more and more popular (Frey and Pommerehne, 1989), in such a way that in the last decades the art market has experienced phenomenal growth, with booms at the end of the 1980s and in the 2000s. The art market grew over 575% from 1991 to 2007 (TEFAF, Art Market Report 2012) and has more than doubled in size within the decade 2004-2014 (Art Basel and UBS's global art market annual report 2019). In 2018, the global art market — which includes dealers and auction sales — recorded $67.4 billion in sales, a 6% increase from the previous year, and reached an estimated number of 39.8 million of transactions, an increase of 2% year-on-year, according to the Art Basel and UBS's global art market annual report 2019. Moreover, art represents nowadays a non-negligible share of total household wealth. A study by Barclays (2012) estimated that high net worth individuals[1] hold in average almost 10% of their wealth in artworks, jewellery, antiques, and other luxury goods in limited supply, which corresponds to an amount greater than $4 trillion in 2012 (Deloitte, 2013). These figures underline the quantitative importance of the art market and looking ahead, this market is expected to follow this positive expansion trajectory. The number of millionaires[2] – art collectors tend to be found in this population– is forecasted indeed to further increase by 34% in 2024 compared to 2019 (Crédit Suisse Global Wealth Report 2019). Furthermore, the Deloitte Art and Finance Report 2019 focusing on the world's ultra-high net worth individuals (UHNWIs)[3] notes that UHNWI's are willing to increase their investments in art and collectibles as part of their overall wealth – looking for art consumption but also for the financial worth of this alternative asset – and forecasts an estimated rise of 55% of their wealth allocated to art and collectibles between 2018 and 2026.

However, art objects are extraordinary economic goods which are not easy to value. The determinants of artwork's value differ from those of equities and other financial assets, because artworks are not pure financial instruments but also consumption goods. On the one hand, artworks can indeed provide financial services to their owners through their potential for price

[1] High-net-worth individuals (HNWI) are defined as individuals with US$1.5 million in investable assets or more.
[2] Millionaires refer here to those with net wealth (financial assets plus non-financial assets less debt) greater than US$1 million (Credit Suisse's Global Wealth Databooks).
[3] Ultra-high-net-worth (UHNWI) individuals are defined as individuals with US$30 million or more in net worth.

appreciation, as artworks are durable goods that can be resold. On the other hand, owning art offers at the same time consumption services, by means of an aesthetic dividend provided by the enjoyment of the artworks' intrinsic qualities and a social reward derived from the prestige and social distinction that owning a masterpiece gives[4]. It is this flow of pecuniary and non-pecuniary payoffs yielded by pieces of art that makes artworks difficult to value.

In contrast to financial assets, art objects are in principle unique original works of art – an extreme case of heterogeneous good– so that each artwork is valued differently by all potential future owners according to the consumption they may obtain from the artwork. Moreover, art markets differ substantially from financial markets. The art market supply is nonaugmentable when we consider artworks of deceased artists and limited when we consider the finite lifetime of living artists. The market is also greatly segmented with half of aggregate art sales by value sold at auctions (with marginal changes year-to-year) and the other half sold by "dealers" such as galleries, shops, private dealers, sole traders and online platforms (Art Basel and UBS, 2019). In addition, transaction costs are high and extended delays are needed to sell, which makes artworks not very liquid assets. Last, owning art entails some level of risk due to possible physical damage, theft, forgery or reattribution, while insurance and restoration are costly. So art prices depend on a combination of specific factors, largely different from those of other assets or commodities, and how they come into being is still a question that is not well understood.

The purpose of this dissertation is to investigate the determinants of art prices, with a focus on auctions. Auction prices are indeed publicly available and reliable, contrary to dealer or private sale prices that are difficult to obtain or uncertain. In addition, auction prices substantially influence the art market, as gallerists, merchants, and collectors consider them as guiding prices (Frey and Pommerehne 1989). This research is based on a cross-disciplinary approach, contributing both to the economics and marketing research fields.

In the last two decades, there has been a growing interest among scholars in auctions and art markets. **Economic and financial studies** have focused primarily on art as an investment, *i.e.* what are the rates of return in art markets, how these returns compare vis-à-vis other investments returns such as equities and bonds and whether it may be relevant to include art investments in a diversified portfolio. Anderson (1974), Baumol (1986), Frey and Pommerehne (1989) Goetzmann (1993), Renneboog and Van Houtte (2002) show that

[4] The Economist (2006) states: "What is the point of being rich if you cannot drink the finest wines while gazing at the world's most famous artworks on the walls of your penthouse flat?"

investments in art compares unfavourably to investments in traditional financial assets – such as stocks, bonds or treasury bills – in terms of risks and returns, so that owning art appears to be rational only if art provides a substantial consumption value in order to compensate for the low financial reward. In contrast, other studies concluded that some segments in the art market and during some periods of time, art can offer larger returns than bonds, treasury bills and gold, sometimes even comparable returns to stocks (Buelens and Ginsburgh 1993, Chanel et al. 1994, Mei and Moses 2002). More recent studies have mainly found that art may provide some diversification benefits in an investor's portfolio, and can therefore play a role as an alternative investment (Mei and Moses 2002, Hodgson and Vorkink 2004, Pesando and Shum 2008, Korteweg et al. 2016). In order to examine prices and returns on the art market, an index of prices is generally constructed using either the repeat-sale regression or the hedonic regression – the two main econometric methodologies used for art market studies.

The repeat-sale regression approach, used by Baumol (1986), Goetzmann (1993), Pesando (1993), Mei and Moses 2002, Pesando and Shum (2008), is based on the prices of artworks which sold two or more times within a certain time period to estimate the fluctuations in value of an average asset (*i.e.* a representative artwork) over the defined period. The application of this method to estimate a price index for art provides the benefit of explicitly controlling for the uniqueness of each artwork transacted but presents obvious drawbacks such as the selection bias derived from considering only repeat-sales on auction house data, while a limited number of resales may prevent to construct a robust price index.

The second approach –the hedonic regression– largely adopted by the literature, a few examples being Chanel et al. (1996), Higgs and Worthington (2005), Kraeussl and Logher (2010) and Renneboog and Spaenjers (2013), uses all transaction data available and consists of regressing the price of each artwork on various characteristics of the objects. The estimated coefficients of the observable characteristics can be interpreted as "implicit prices" of each attribute. This approach allows to determine consumer's relative valuations of the characteristics and makes it possible to identify price determinants, *i.e.* the relevant explanatory variables for determining art prices. When prices are regressed not only on a set of characteristics but also on one or more time dummies, a price index can be constructed. The advantages of using a hedonic regression are that all transactions can be included in the estimation and that price determinants can be recognized. But one of its main drawback is that the regression may be biased depending on the characteristics considered to describe the objects and to control for the differences in quality between works (omission of important characteristics or inadequate choice of characteristics).

Thus, a related strand of the literature has focused on the determinants of the prices of art works. Since most empirical studies use auction data, the set of characteristics included in the hedonic regression are usually the ones made available by the auction houses, such as the name of the artist, type of work, size, medium, support, subject matter, and some sale characteristics such as the auction house, location, year and month of sale. However, the number of characteristics considered remains relatively small and focuses essentially on a few artists' characteristics, artworks' physical attributes and sale aspects. Efforts to identify new determinants of prices have been limited in the literature, certainly because the information is more difficult to collect and time-consuming. The few studies that have contributed to widen the set of explanatory variables of art prices have focused on measuring reputation, the strength of attribution or the provenance (Campos and Barbosa 2008, Marinelli and Palomba 2011, Renneboog and Spaenjers 2013), on anchoring behavior (Beggs and Graddy 2009, Graddy et al. 2015), on financial and macro-economic market factors (Goetzmann et al. 2011) and on fad and sentiment (Pénasse et al. 2014).

It should here be mentioned that a peculiarity of art auction markets is that around one third of artworks presented for sale do not sell (Artprice Annual Report 2017), *i.e.* when the highest bid does not reach the seller's reserve price. Most previous studies exclude "bought-in" lots from their sample, which are lots put up for sale but that remain unsold, as bids do not reach the seller's reserve price. This common selection bias found in the literature on art prices at auction has been pointed out by a few studies (Collins et al. 2009, Marinelli and Palomba 2011, Farrell et al. 2018) that have subsequently explored not only auction prices but also the probability of sale of artworks.

In the **management science literature**, there have been a few papers that have given attention to the impact of auction house and auctioneer practises on auction prices. First, some studies have found a statistically significant impact of buy-in penalties (Greenleaf and Sinha 1996), fees and commissions (Yao and Mela 2008) and buyer's premia (Morwitz et al. 1998) applied by auction houses on auction prices. Second, regarding the practises authorised or not by auctioneers over the course of the auction, He and Popkowski Leszczyc (2013) find that allowing jump bidding by bidders positively influences ending prices. Finally, with respect to auction houses marketing strategies, D'Souza and Prentice (2002) and Ducarroz (2016) show that some promotional efforts by auction houses have a positive effect on final auction price.

In this dissertation, we propose to delve deeper into the factors determining art prices as well as artworks' probability of sale. We draw upon two disciplines, economics and marketing, that both enrich our understanding of art prices at auctions. This work of research concentrates on four main directions, that have received little attention by the literature. First, we examine how vertical differentiation (quality related) and horizontal differentiation (tastes related) affect the probability of sale and the market price of auctioned artworks (Chapter 1). We propose an original set of variables accounting for vertical differentiation, which is particularly important as art markets suffer from quality uncertainty and information asymmetries. To do so, we explore a young art market where the art objects exchanged have a noteworthy hybrid nature: the comic art market. Second, we investigate the influence of subjective perceptions on art prices and whether shared human judgements explain part of art value (Chapter 2). Thanks to a survey, we test if and how consensus on subjective perceptions, more specifically consensus on liking and emotions, from insiders (art collectors) and outsiders (non-collectors) translate in prices at art auction. Third, we empirically explore the impacts of marketing strategies implemented by auctions houses and human auctioneers[5] on sale rates, on prices realized at auction, but also on the difference between auction prices and pre-sale estimated prices (Chapter 3). Using video recordings and a unique dataset, we analyse the effect of auction houses' organising and advertising work as well as the behavior of human auctioneers. Fourth, we focus on the sequence of auction bids and whether it has an impact on auction prices (Chapter 4). Using a hand-collected database of sequences of bids at art auction, we investigate whether the degree of aggressiveness and changes in rhythm (acceleration and slowdown) in different phases of the sequence of bids tell about the final prices.

For this dissertation, we construct **four original databases**. They are based on the same comic art auction sales. We focus on the comic art market as this market has been little investigated in the literature and presents noteworthy features that allow to explore many different questions.

The first database, which we call "differentiation database" as it serves for our first chapter on horizontal and vertical differentiation, includes 1101 observations. These observations are auction prices of 1101 comic artworks auctioned over seven sales (by six different auction houses as we include two sales by Christie's) between March 2017 and May

[5] It is common to find in the literature the term "auctioneer" indistinguishable from the seller or to designate the auctioning agent (Hossain et al. 2013). In this chapter, we call "auction house" a firm that auctions (at least partly) on-site and "auctioneer" the human professional in charge of conducting oral outcry auctions.

2018 in Paris and Brussels. It includes a set of variables that describe in detail the artwork and the artist. Information to construct these variables are collected by hand from *i)* the written description of the lot in pre-sale catalogues, *ii)* the pictures of the lots provided by the catalogues which were analyzed with the imaging software ImageJ©, *iii)* Bédéthèque©, a French website specialized in international comics, and *iv)* the Amazon© website. Then, for the three other databases, we use the same observations (all or part of them). Some of the variables of the "differentiation database" describing the artwork and the artist are systematically employed in the other databases.

The second database, which we call "consensus database" (used for chapter 2), includes 124 observations. These observations are auction prices of 124 comic artworks auctioned by Artcurial in April 2017. The "consensus database" involves a set of variables related to subjective perceptions on comic art of insiders and outsiders of the comic art market. These variables are collected by means of a survey we conducted using the software Limesurvey© with comic art collectors (market insiders) and non-collectors (market outsiders). The other set of variables on artwork and artist characteristics comes from the "differentiation database".

The third database, which we call "auction host database" (used in chapter 3), contains 1101 observations which are auction prices of 1101 comic artworks (the entire sample of the "differentiation database"). This database includes a set of variables about the auction house and auctioneer practices. Information to construct these variables are collected from *i)* the written description and picture of the lot in the pre-sale catalogues, *ii)* recordings of auction sales which are transmitted live on the Drouot Live platform or on auction houses' own platforms (for Artcurial and Christie's), thanks to the software ActivePresenter©, and *iii)* the websites of French and Belgian auction houses. The other set of variables on artwork and artist characteristics comes from the "differentiation database".

The fourth and last database, which we call "bid dynamics database" (used in chapter 4), includes data on prices and bid dynamics of 547 auctioned comic artworks. On the whole sample of the "differentiation database", we select the sold lots for which we observe two or more bids. Data on bid dynamics are gathered from video recordings of auction sales which are transmitted live on the Drouot Live platform or auction houses' own platforms, thanks to the software ActivePresenter©. Another set of variables on artwork and artist characteristics stems from the "differentiation database". A last set of variables linked to the sale environment comes from the "auction host database".

This research work is organized into four chapters.

Chapter 1 investigates how vertical (quality related) and horizontal (tastes related) differentiation influences *i)* the probability of sale, and *ii)* the market price of auctioned artworks. Pieces of art are an extreme case of differentiated goods and bear a set of characteristics involving both horizontal and vertical differentiation (Waterson 1989).

The literature emphasizes the impact of horizontal differentiation variables on prices such as size, medium or subject matter (Anderson 1974, Agnello and Pierce 1996, Higgs and Worthington 2005, Renneboog and Spaenjers 2013, among others) yet leaving aside the study of the influence of vertical differentiation variables on prices, which account for the quality of artworks. This latter dimension is particularly important in art markets that suffer from quality uncertainty and information asymmetries (Akerlof 1970, Von Ungern-Sternberg and Von Weizsacker 1985, Beckert and Rössel 2013). Czujack (1997), Onofri (2009) and Marinelli and Palomba (2011) have proposed two proxies of the quality of artworks but which present inherent issues. The fact that the literature has almost exclusively considered horizontal differentiation variables is due to two practical issues. Capturing vertical differentiation is first an empirical challenge on the segments of the art market commonly analyzed and second is complicated due to the rough description of artworks in electronic databases and auction catalogues. Using the hedonic price approach, we analyse in this chapter whether vertical differentiation factors determine art prices by solving these two issues. First, we focus on the comic art market, a young art market which has almost never been analyzed by scholars, for which vertical and horizontal differentiation variables can be neatly distinguished because of the hybrid nature of the goods exchanged. By doing so, we measure vertical differentiation variables (accounting for acknowledged quality, e.g. artist's reputation, artist's role, artist's recognition, artworks' commercial and critical successes, number of heroes appearing on a page) in addition to classical and new horizontal differentiation variables (accounting for tastes, e.g. size and medium among others for horizontal differentiation variables commonly found in the literature; style, composition and color as new horizontal differentiation variables). Second, we built for this research an original hand-collected dataset and complete pre-sale auction catalogues information with a more thorough description of the artworks, crossed with external information. Our dataset gathers 1101 original comic art lots auctioned in 2017 and 2018 on the European comic art market, *i.e.* the French-Belgian market. Another bias commonly found in the literature is a sample selection bias: most previous studies exclude unsold artworks from the sample. As our sample contains both sold and unsold lots, we estimate Tobit 2 models to enhance the relevance of our regressions, and thus test for the significance of our variables

throughout the entire sale process, *i.e.* not only on the effective auction price but also on the probability of sale.

We find that none of the variable accounting for vertical differentiation significantly influences the probability of sale. This result shows that, due to various psychological traits (greed, overconfidence, or excitement about quality), comic art sellers sometimes overvalue their artwork compared to the buyers while the reverse occurs some other times. Overall, overvaluations from one by another (sellers and bidders) compensate each other, so that in the end quality does not change the probability of sale. This general result still holds on more homogeneous subsamples, except for quality-related variables on the artist that increase sales eventually. In contrast, better quality leads logically to a premium: on the full sample, all the variables accounting for quality have a highly significant and positive influence upon artwork prices.

Regarding horizontal differentiation now, some horizontal features have a steady influence on sales and prices. This finding suggests that individual tastes about physical and artistic attributes do not always compensate each other: on the contrary, mutual preferences, trends, and fashion play a definitive role in comic art auctions, so that tastes shared by the majority lead to common inclinations and aversions. Moreover, with respect to the new variables of horizontal differentiation included in this research, we find that color, composition and style significantly influence the probability of sale and – for specific types of comic art – the sale price too.

Finally, when questioning the generality of our results, we find that comic art market has many similarities with traditional painting markets, despite some intrinsic specificities.

Chapter 2 empirically examines the role of subjective perceptions and especially of consensus on subjective perceptions, in determining prices. Previous studies have focused on objective price determinants from different categories, such as artworks' physical attributes (Higgs and Worthington 2005, Marinelli and Palomba 2011, Ma et al. 2019, among others), artist-related variables (Ekelund et al. 2000, Campos and Barbosa 2008, Ursprung and Wiermann 2011, among others) and sale characteristics (Beggs and Graddy 1997, Renneboog and Van Houtte 2002, among others). However, there is also a subjective dimension of liking and emotion involved in the consumer's utility function and therefore in artwork prices. An economic study by Ma et al. (2019) has recently pointed out the impact of emotions, especially the emotion of pleasure, on prices in an experimental study focused on color. And if many

individuals share the same subjective judgment about an artwork, as pointed out by Graham et al. (2010), is the price affected? Or are subjective perceptions only a personal component that affect individuals' appraisals and valuations? To our best knowledge, there has been no research in marketing or economics on consensus about subjective judgment in an art pricing context. The purpose of this chapter is to study the effects of consensus on liking and emotions in two different social groups (market insiders and outsiders) on art prices at auction.

To measure subjective perceptions, we built a questionnaire that was sent to collectors (insiders) and non-collectors (outsiders). The stimuli consisted of 124 pictures of comic artworks sold by the auction house Artcurial on the 8th of April, 2017 in Paris. We focus on the comic art market since it is one of the rare art market for which there is an online forum easily accessible that gathers many collectors. For each artwork, we measured the emotional valence (*i.e.* positivity or negativity of emotions) and the liking degree of participants. Our approach explores the relationship between real art auction prices and the consensual aesthetic and emotional appreciation of novices and experienced subjects using a hedonic pricing model. This study is the first to examine subjective explanatory variables of real art prices and includes a particularly large number of participants compared to previous studies on art perceptions.

Our main findings are as follows. Our results show that liking and emotional consensus affect prices differently depending on the social group from which they are issued. More precisely, we observe that artworks generally achieve higher prices when they are consensually liked by collectors and eliciting positive emotion to them. This result shows that collectors, who are art market insiders, have integrated common aesthetic norms about what is considered as "good art" and prices are determined depending on artwork compliance with their principles and what they think is good art. Moreover, we unexpectedly find that what is consensually liked by and evokes positive emotions to novice subjects generally achieve lower prices at auction. This finding shows that aesthetic codes shared among collectors do not spread to outsiders, which are also not aware of the fads that drive the art market. Even more, insider liking judgments and emotions go in the opposite direction with respect to outsider judgments and emotions, which corroborates Bourdieu's assumption (1979) that people engaging in arts are driven by an individualisation process through which they aspire to stand out above the crowd. Last, we find that collector consensus on liking is positively influenced by the artist recognition, whereas for naïve subjects, art liking is negatively impacted by the artist recognition. This shows that outsiders do not share at all art market standards. Our findings suggest that art prices cannot be understood in large aesthetic terms but rather only in aesthetic codes established by and shared among insiders.

Chapter 3 addresses whether auction houses' organizational and promotional strategies on the one hand, and auctioneers' behavior when conducting auction sales on the other hand determine the probability of sale, prices or price-estimate ratios for otherwise equivalent art pieces. While this article draws upon two disciplines, marketing and economics, that both enrich our understanding of auctions, these questions will be answered from a marketing perspective.

The existing literature has given little attention to the "third player" of an auction sale, *i.e.* the auctioning agent, besides seller and bidders. In many studies, no distinction is made between the seller and the auction host or this later is considered as a passive intermediary between the seller and the potential buyers. Yet, an auction host can take several actions that can have an impact on auction outcomes. Previous studies have mostly focused on the rules governing auction sales that are chosen by the auction host, such as the auction format (Maskin and Riley 1980, Harris and Raviv 1981, Milgrom and Weber 1982), the nature of bidding (Isaac et al. 2005, He and Popkowski Leszczyc 2013), the level of buyer's and seller's fees and commission rates (Morwitz et al. 1998, Yao and Mela 2008, Ginsburgh et al. 2010) and the presence of penalties or guarantees (Greenleaf et al. 1993, Greenleaf and Sinha 1996, Greenleaf et al. 2002). Once the rules of the auction sales set down by the auction host, all pre-sale activities, *i.e.* the actual and daily work of the auction house and auctioneer, remain. Auction houses have organisational and promotional tools at their disposal prior to sale, while auctioneers can use different kind of interventions when conducting auction sale. We can find some rare variables related to these aspects disseminated and tested in a few studies, like the lot order of sale (Beggs and Graddy 1997, Campos and Barbosa 2008), the presence of an illustration in pre-sale catalogues (Agnello and Pierce 1996, D'Souza and Prentice 2002) and the length of the lot description (Cinefra et al. 2019). Moreover, human auctioneer's actions throughout on-site outcry auction sales have not been empirically studied in past research. Lacetera et al. (2016) measure a performance variability across auctioneers that suggests that auctioneer's performance during the auction is determining. Using a hedonic price approach, we examine the impact of auction houses' daily work and auctioneers' way of conducting auctions on sale outcomes: the probability of sale, the final purchase price and the hammer price in percentage of the pre-sale mean estimated price. To do so, we have constructed a dataset based on pre-sale catalogues information and video recordings of auction sales. The dataset includes 1101 artworks auctioned between March 2017 and May 2018 by six different auction houses.

Our results show that some organizational, promotional and auctioneer effects play a role in explaining sale outcomes. First, we find that many organizational effects exert an influence upon the probability of sale and prices, such as the level of competition with similar sales, the number of lots from the same artist, the presence of a top-up or the decision of selling lots including multiple items. Second, the promotional work carried out by auction houses results in increases in artwork prices. The presence of a written positive comment ahead of the sale especially seems to be decisive: it has a highly significant and positive influence upon the probability of sale, prices and the price-estimate ratio. Finally, we show that the human auctioneer has a prominent impact on outcomes. Our results highlight on the one hand that the usage of humor by the auctioneer plays a relevant role in determining sale probability and auction prices, and on the other hand that the price-estimate ratio is mostly determined by the behavior of the auctioneer, whose role as salesman appears to be crucial in selling an entertaining auction experience in a climate of trust, rather than in bringing an expert's point of view about the items for sale.

Chapter 4 explores whether and how the bid dynamics influence the auction final price. The classical auction theory assumes that bidders enter an auction with a fixed valuation for the goods presented for sale. Yet, different empirical studies provide evidence suggesting that bidders do not comply to ex-ante value assessments but rather adjust their reserves throughout the auction.

One first stream of research has investigated different characteristics of the auction process that have an impact on final prices. For example, the opening bid in online auctions has a significant impact on the final auction price (Häubl and Popkowski Leszczyc 2003, Lucking-Reiley et al. 2007, Ku et al. 2005). Also, bidding involves emotional aspects, hence the phenomenon called "auction fever", which can impair decision-making and lead to higher prices (Ku et al. 2005, Jones 2011, Adam et al. 2011, Adam et al. 2015). In addition, the duration of an online auction and the time limit in such auctions appear to have a significant impact on the final auction price (Bajari and Hortaçsu 2003, Ockenfels and Roth 2006, Haruvy and Popkowski Leszczyc 2010, Cao et al. 2019). Aside of these studies focused on summary statistics of the auction process to highlight the importance of bidding strategies, a second body of literature has analyzed the bid dynamics, *i.e.* the distribution of bids over the course of an item auction. These studies have developed advanced data visualisation of the sequence of bids (Shmueli and Jank 2005, Hyde et al. 2006, Shmueli et al. 2006) but also models of online bidding dynamics to forecast bid dynamics (Park and Bradlow 2005, Wang et al. 2008, Jap and

Naik 2008) and to better understand which factors influence the online bid dynamics at various moments of an auction (Reddy and Dass 2006, Bapna et al. 2008). We note that most of these studies are focused on the bid dynamics of online auctions, for which data are freely and easily available.

In this chapter, we explore the bid dynamics of live English auctions – which differ from online auctions by many different aspects –, and more specifically whether the degree of aggressiveness of bids and the pace of the auction appear to be neutral with regard to the final auction price or if rather they can affect the auction outcome. We assume that if bid dynamics have an influence on prices, it is because bidders' reserve prices (the highest price they are willing to pay for an item) are "fuzzy", *i.e.* reserves of bidders adjust throughout the auction process (as pointed out by Cramton 1998, D'Souza and Prentice 2002, Heyman et al. 2004 and Hou 2007). The existence of fuzzy reserves gives bidders a rationale to adopt bidding strategies. Yet, these strategies are likely to differ depending on the phase of the auction (beginning, middle or end of the auction) as the auction context changes. We therefore construct indexes capturing the bid dynamics for each of the three main stages of the auction. Our hand-collected dataset consists of prices, sequences of bids and characteristics of 547 art objects sold at auction between March 2017 and May 2018.

We confirm the role of bid dynamics reflecting strategic behaviours of bidders in explaining final auction prices. Following our theoretical framework, this noteworthy finding supports the importance of bidders' fuzzy reserves that lead bidders to bid aggressively or mildly. We find that aggressive bidding has a significant and positive impact on the hammer price, especially at the beginning and end of the auction. This aggressiveness comes from bidders who are particularly motivated by the prospect of winning the lot, rather than preserving their surplus. At the end of the auction, the effect of aggressive bids on the auction outcome is lower than at the beginning of the auction, as final duels may give rise to some despondency amongst bidders that attenuates the impact on price. Then, we find that the pace of the auction substantially affects the price. Initial arousals, which may be interpreted by bidders as signals of strong interest towards the lot (*i.e.* they may update the common value component of their valuation), boost the final price. In addition, late accelerations, which reflect ultimate duels of bidders, increase the hammer price. These findings suggest that motivation effects – coming from bidders who aim at winning the auction rather than hunting for a bargain – seem to be the strongest ones in explaining final prices compared to alternative effects such as despondency.

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Chapter 1:
Horizontal vs. vertical differentiation in comic art auctions[1]

Abstract:

This paper investigates how vertical (quality related) and horizontal (tastes related) differentiation influences *i)* the probability of sale, and *ii)* the market price of auctioned artworks. By including unsold lots, we correct the selection bias commonly found in the literature dealing with hedonic prices. A new art market is explored here: original comic artworks, that have a noteworthy hybrid nature. We propose an original set of variables accounting for vertical differentiation on this market (commercial and critical success, artist's reputation, role and recognition…), which is particularly important as art buyers are often uncertain regarding the actual quality of the lots for sale. We find that vertically differentiated artworks do not sell better but call for a premium. As regard to horizontal differentiation, newly explored variables (color, composition and style) have a significant effect upon sales and often auction price.

Keywords: *Art prices, auctions, differentiation, hedonic regressions, comic art market.*

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[1] This chapter is written with Régis Blazy.

1. Introduction

A piece of art is original and unique. Created by an individual – the artist –, artworks are an extreme case of differentiated goods. Differentiation between goods was originally defined by Chamberlin (1933): "*A general class of product is differentiated if any significant basis exists for distinguishing the goods of one seller from those of another. Such a basis may be real of fancied, so long as it is of any importance whatever to buyers, and leads to a preference for one variety of the product over another*". Two types of differentiation are essentially distinguished in the literature: horizontal differentiation and vertical differentiation (Waterson 1989). Goods are horizontally differentiated when consumers do not agree on a common ranking: even if those goods were sold at the same price, heterogeneous consumers would not choose the same, depending on their own tastes. Goods are vertically differentiated when consumers agree on a common ranking of perceived product quality: facing two vertically differentiated goods sold at the same price, various consumers would therefore opt for the same product.

Most goods bearing a set of characteristics embody both types of differentiation. Art is no exception: every artwork can be associated to a specific set of characteristics. In this paper, we consider both types of differentiation on this market. Firstly, *horizontal differentiation variables* refer to individual tastes on artworks: they relate to characteristics such as size, medium, color, and style. Art consumers cannot reach a consensual ranking among artworks when considering such characteristics. For instance, a smaller, lighter and/or more realist artwork cannot be considered as "better" than a bigger, darker and/or more caricatural artwork. The appraisal of these characteristics obviously depends on personal taste. Secondly, *vertical differentiation variables* attached to artworks (e.g. artist's reputation and recognition, commercial and critical successes) relate to their acknowledged quality. Let us imagine two identical artworks (*i.e.* same size, topic, and style), one being from a reputed artist honored by an award for his/her career, and one from another artist who has not received any similar distinction. If the two artworks were at the same price, all the art consumers would agree on the same ranking and would go for the artwork by the former artist.

Hedonic approaches found in the literature assume that consumers do not derive utility from goods *per se*, but from the characteristics they have (Lancaster 1966). Such approaches are useful to test for the determinants of artworks' prices. In practice, hedonic models consist in regressing the price of each artwork (explained variable) on its observed characteristics (explanatory variables). The characteristics of artworks previously explored by the literature

are mostly physical attributes (*i.e.* horizontal differentiation variables) such as size, medium, period of production, subject matter, and color (Anderson 1974, Agnello and Pierce 1996, Higgs and Worthington 2005, Ma *et al.* 2019, among others). Explanatory variables accounting for the artist are also included in these models, such as the artist's name or school (dummy variable), the artist's age, his/her nationality, or living status (Buelens and Ginsburg 1993, Chanel *et al.* 1996, Ekelund *et al.* 2000, Onofri 2009). Economists often consider explanatory variables related to the certitude of attribution, such as signature, publications in catalogues, authenticity proof or expertise (Czujack 1997, Campos and Barbosa 2008, Renneboog and Spaenjers 2013). The latter set of variables is of primer importance as art markets are subject to authenticity issues and fakes. Previous studies have also suggested that art prices depend upon exogenous features such as the sale environment (Pesando 1993, Mei and Moses 2002, Renneboog and Van Houtte 2002, Beggs and Graddy 2009, among others), the macro-economic context (Goetzmann *et al.* 2011), and the level of confidence of stakeholders within the art markets (Pénasse *et al.* 2014).

Overall, variables accounting for the quality of artworks (*i.e.* vertical differentiation variables) have received little attention in the literature so far. This is a concern as artworks are experience goods: art buyers are then subject to information imperfections when considering the high level of uncertainty on the actual quality of artworks (Akerlof 1970, Von Ungern-Sternberg and Von Weizsacker 1985, Beckert and Rössel 2013). Uncertain quality is a well-known market imperfection that may generate serious market failures. Observable signals on quality are thus of major importance for art markets, especially for contemporary art (where artists have not gone down in art history yet). In such context, artworks displaying observable vertical characteristics are likely to sell better and call for a premium as they strengthen the buyers' confidence. Czujack (1997), Onofri (2009) and Marinelli and Palomba (2011) tried to overcome this limitation by considering two proxies of the objective quality of artworks: *i)* exhibitions and *ii)* provenance. However, these authors pointed out an inherent issue of the former variable. Indeed, exhibitions of artworks are undoubtful signs of their acknowledged quality. That said, artworks for sale coming from private collections may be of high quality as well, despite not having had the chance to get exhibited. Considering the latter variable, provenance captures unfortunately two dimensions at the same time. On the one hand, a prestigious provenance is undoubtfully a sign of quality, but on the other hand, it also accounts for certification of attribution, and thus relates to the risk of buying fakes.

The fact that hedonic approaches of art markets consider almost exclusively horizontal differentiation variables is due to two practical issues. Both must be solved to account for vertical differentiation.

Firstly, capturing vertical differentiation is an empirical challenge on the segments of the art market commonly analyzed so far. Undoubtedly, other segments need to be investigated. Our research follows this avenue by focusing on the original comic art market for which vertical *vs.* horizontal differentiation variables can be distinguished neatly. Indeed, original comic artworks are of hybrid nature: those are, at the same time unique pieces of art originally drawn by an artist, and also commercial goods gathered and printed on a large scale for the purpose of selling comic books. Those hybrid features make it possible to measure vertical differentiation variables (accounting for acknowledged quality, e.g. commercial success, critical success, number of heroes appearing on a page) in addition to horizontal ones (accounting for tastes). Up to now unfortunately, this specific segment of the art market has almost never been analyzed by academics. One recent research (Bocart *et al.* 2019) has been conducted on the comic art market, but it principally assesses the returns of comic artworks in comparison with stocks and bonds.

Secondly, proxying vertical differentiation is complicated due to the rough description of artworks in most databases and auction catalogues. To overcome this difficulty, we built for this research an original hand-collected dataset. Our dataset gathers 1101 original comic art lots, auctioned by six different auction houses from March 2017 to May 2018 on the European comic art market, *i.e.* the French-Belgian market. As the pre-sale auction catalogues provide nearly no information about the acknowledged quality of auctioned lots in their descriptions, we completed them with a more thorough description of the artworks, crossed with external information. This systematic method allowed us to build proxies of vertical differentiation for every lot. Namely, we used *i)* the written description of the lot in the pre-sale catalogues, *ii)* the pictures of the corresponding artworks (those were then analyzed with software ImageJ©), *iii)* the authors' biographies stemming from Bédéthèque© – a French website specialized in international comics –, *iv)* Amazon© rankings of the published corresponding comic books (sales and critics).

Another bias commonly found in the literature is related to sample selection. Previous studies – apart from those of Collins *et al.* (2009) and Marinelli and Palomba (2011) – exclude "bought-in" artworks from the sample, *i.e.* lots presented for sale but that remain unsold. Art is usually auctioned following the "ascending price" or "English" format. For most European comic auctions, any seller can indicate a reserve price (*i.e.* the minimum price from which (s)he

agrees to sell) to the auction house before the auction takes place. The lot does not sell eventually if the highest bid does not exceed the seller's reserve price. According to Artprice©, between 30% to 40% of lots are unsold in fine art auction sales on average: ignoring them may generate selection bias in the sample. As our sample contains both sold and unsold lots, we can estimate Tobit 2 models to enhance the relevance of our regressions, and thus test for the significance of our variables throughout the entire process, from the possibility of sale to the effective auction price.

In a nutshell, by using original proxies of vertical differentiation, and by including unsold lots in our sample, we can test for the influence of vertical differentiation variables, *i.e.* quality-variables. Namely, this research analyzes the impact of quality on *i)* the probability of sale, and *ii)* observed market price. These questions relate to the adjustment of the bid/ask reserve prices when the quality of artworks changes. Such quality being fundamentally multidimensional, it must be proxied by several criteria.

This paper contributes to the literature in three principal ways. First, by proposing a new analytical framework, this research sheds light on the crucial role of vertical and horizontal differentiation throughout the whole sale process. Second, this contribution is made possible by bringing to the literature a missing set of vertical differentiation variables accounting for art quality while most published works restrict the analysis to horizontal differentiation and buyers' tastes. We also extend the set of horizontal differentiation variables commonly found in the literature. From that view, adding variables related to color, style, composition, and a broad range of art subjects matters. Third, our paper originally explores in details a new segment of the art market – comic art – and investigates the similarities of this segment with the others.

In this paper, we first present the market of original comic art (section 2). Then, we present our data and methodology (section 3), addressing the sample choice, the collected variables and the modeling strategy. Then, we present and discuss our estimates and perform some robustness checks (section 4). Last, we discuss how our findings on comic art market can be generalized to other art markets (section 5). Section 6 concludes.

2. The comic art market

Will Eisner (1985) – one of the earliest and most recognized comic book artists to work in the American comic book industry – described comic art as "*the arrangement of pictures or images and words to narrate a story or dramatize an idea*". Nowadays, American comics, European *bande dessinées (BD)*, and Japanese manga are the three main modern comics'

worldwide culture, which date back to the 19^{h} century (Mazur and Danner 2017). In practice however, two main original comic art markets are active nowadays: the American and the European ones, since original manga are not significantly traded, principally for cultural and copyright reasons. Our study focuses on the European comic art market that gather homogeneous actors (e.g. artists, collectors, auction houses, and galleries).

Original comics are all works from the comic artist's hand (Deneyer 2016). They contain traces of the artistic process followed by the comic designer. They are therefore unique artworks, infused with the artist's imagination, creativity and know-how. At the beginning, once the storyline is written, the comic designer tells the story through successive images he draws in panels. (S)he segments the storyline in shots in panels on several pages. One page of successive drawn panels forms a board and the set of boards constitutes a comic book (usually between 40 and 50 boards). A coverpage is commonly added on the top. Most of the time, these boards are first drafted in pencil, then inked at their final stage (each step being executed by one person or by different artists). Colorization can be made either directly on the board or separately (*i.e.* applied on a separate material). When the colors are uncoupled from the drawing strokes, the colored separate material is called a "coloring". Original boards drawn by hand by the comic artist are then printed to get published as a comic book. Overall, original comics sold on the market can be of five different natures: *i)* board (the most common type of art), *i)* draft, *iii)* coverpage, *iv)* coloring, and *v)* illustration (*i.e.* a drawing independent from a board).

Before the 1970's, original comics were neglected by the comic publishers and even by the artists themselves. The major focus was on the outputs (*i.e.* comic books) rather than on the inputs (*i.e.* original boards) that served to produce them. Hence, original comics were often left, thrown away, or destroyed. From the 1970's, some comic art lovers began to show an interest in original comics. Comic artists started to give their boards and originals could be found in some few specialized bookshops' backrooms. The situation has evolved since then. In the 1980's and 1990's – as the number of comic art lovers and collectors was increasing –, comic artists started to sell their boards on a more regular basis. Original comics could be bought in specialized comic bookshops and in gallery-bookshops. Finally, galleries specialized in comic art succeeded them in Brussels and Paris. These galleries work as any other art sellers and participate to art fairs such as Art Paris and BRAFA (Brussels). Original comics are now subject to scheduled exhibitions in museums, especially in France and in Belgium. The first devoted museum to comic art was the *Centre Belge de la Bande Dessinée* in Brussels in 1989. There are also private museums in Belgium dedicated to some comic artists, as Hergé or Jijé. France followed that path too. In 1991, the *Musée de la Bande Dessinée* opened in Angoulême, a

middle-sized city that welcomes every year the international European comic festival. Exhibitions of comic artist's artworks in famous French museums have been hold more recently. Enki Bilal was exhibited in the *Louvre* from December 2012 to March 2013. Hergé was exhibited in the *Grand Palais* from September 2016 to January 2017.

From the 2000's, auction houses in Paris and Brussels entered the market, attracted by the market dynamism and price increases. Today, more than ten auction houses organize comic art sales. Artcurial was one of the first to open a comic art department in 2005. The two most important international auctions houses followed this trend more recently: Sotheby's in 2012 and Christie's in 2014. In total, there are annually about thirty sales dedicated to original comics in France and in Belgium. Recently, Internet auctions have got a significant place in the comic art market, such as Catawiki© that compete in terms of turnover with Artcurial (ActuaBD, 27/05/2016). In the end, three comic art sale channels exist nowadays: *i)* private treaty sales (sales between individuals), *ii)* galleries, and *iii)* auction houses (virtual or not).

The rising popularity of original comic art during the last decades leads this young art market to record dramatic prices increases. The sole research on the European comic art market (Bocart *et al.* 2019) reveals that investments in these alternative assets achieved yearly average returns of 25% over the period 2009-2017, clearly outperforming European equities and bonds, and European fine art returns. In 2000 for instance, the collector Francois Dougier – expert at Coutau-Bégarie auction house – testified he bought a board from the comic serie *XIII* (William Vance) at 1 200 € (in current prices) at Daniel Maghen gallery in Paris. In 2016/2017, boards from this serie were sold by the same gallery at prices ranging between 5 000 € and 15 000 €, which corresponds to an average rate of return of 733% in 16 years. In 2008, the coverpage of *Tintin en Amérique* (Hergé) was sold by Artcurial for 764 218 € (buyer's premium included). Four years later, the same board was resold for 1 338 510 € (buyer's premium included), almost doubling the 2008 initial price. Up to now, the record sale for a European comic artwork is the sale by Artcurial of a double board from the serie *Tintin* by Hergé, sold at 2,65 million euros (buyer's premium included), more than three times its estimation (Le Monde, 24/05/2014). Hergé holds most of the record prices for original comics. Other greatest masters of European comics are André Franquin, Albert Uderzo, Moebius / Jean Giraud, Enki Bilal, Hugo Pratt. Their works usually sell well and at high prices (Huffington Post, 30/04/2016).[2] We observe

[2] Several examples follow: a coverpage from the serie *Astérix* by Albert Uderzo sold at 1,45 million euros by Art Richelieu auctions in 2017; a coverpage from *Gaston Lagaffe* by André Franquin (324 025 €, Artcurial auctions 2010); a board from *Nikopol* by Enki Bilal (361 000 €, Artcurial auctions 2015); a board from *Le Garage*

also notable price increases for artworks by confirmed artists, especially those supported by strong galleries such as Philippe Druillet, Milo Manara, Nicolas de Crécy, Joann Sfar, Ana Mirallès, and Jean-Pierre Gibrat.[3]

These examples highlight the significance of prices that can be reached by original comics for some years now. Overall, although quite recent, the comic art market has developed steadily and rapidly to be nowadays of meaningful size.

3. Data and methodology

3.1. The sample

Our hand-collected dataset gathers the prices and characteristics (physical attributes, authors' career, publication, success, etc.) of 1101 original comics (*i.e.* lots) auctioned by six different auction houses between March 2017 and May 2018, in Paris and Brussels. Auction sales are unique channels to provide public information about the market prices, contrary to galleries or private sales where those are more difficult to collect, mostly for confidentiality reasons. Besides, auction prices notably influence the art market, as gallerists, merchants, and collectors consider them as guiding prices (Frey and Pommerehne 1989).

We consider all comic artworks for sale in order to avoid any selection bias (Collins *et al.* 2009, Marinelli and Palomba 2011). Among them, the distribution of the lots being sold eventually varies from one sale to another: on average, they represent 72% of the total sample. The distribution of the sampled lots between the six auctions houses follows: Christie's (30,2%), Coutau-Bégarie (14,4%), Cornette de Saint Cyr (18,5%), Artcurial (17,1%), Huberty-Breyne (10%), and Millon (9,8%). Huberty-Breyne and Millon's sales took place in Brussels, and the others in Paris. We rejected one auction sale by Vermot et Associés because they did not provide all artworks images, and one electronic sale by Catawiki© as the conditions of the sale were not comparable (Internet auctions). Our data are cross-sectional over a period of one year, which allowed us to have the most exhaustive data on this year and the most recent one (03/2017-05/2018). As this market is young and is getting set up as an institution, auction house

hermétique by Moebius (278 960 €, Artcurial auctions 2015); an illustration from *Les Éthiopiques* by Hugo Pratt (391 840 €, Artcurial auctions 2014).

[3] As recent examples, we can cite: a painting by Philippe Druillet sold at 126 400 € by Artcurial auctions in 2014; an illustration by Milo Manara (35 090 €, Millon auctions 2016); an illustration by Nicolas de Crécy (75 787 €, Artcurial auctions 2013), a coverpage by Joann Sfar (53 100 €, Artcurial auctions 2014), a coverpage by Ana Mirallès (41 480 €, Christie's auctions 2014), an illustration by Jean-Pierre Gibrat (67 500 €, Christie's auctions 2014).

experts give more detailed information, which was not the case at the beginning, when the descriptions of the lots were rudimentary and often incomplete. Last, the auctions took place at different seasons, to prevent any seasonal effect (Agnello and Pierce 1996, Worthington and Higgs 2006).

Our first source of information comes from the pre-sale catalogues that contain descriptive presentations of the auctioned lots. We use these descriptions to build control variables and variables accounting for horizontal differentiation. The pictures of the lots that come with each description are also used to build vertical differentiation variables. We use ImageJ© imaging software to describe coloring and inking. The second source of information stems from Bédéthèque© (a website dedicated to comics[4]) and Amazon©. Both websites deliver detailed information on the artist's reputation, the commercial and critical success.

3.2. The variables

The endogenous variables are *i)* the sale of the auctioned lot (dummy variable equal to one when the artwork is sold and zero otherwise), and *ii)* the auction price (in log, buyer's commission included). For the latter variable, we have access to the *hammer price* (last bid approved by the auctioneer, *i.e.* price without fees) and the *price buyer's premium included* (*i.e.* the final price paid by the buyer to the auction house). We do not consider hammer prices, since buyers include commissions and charges when bidding. Thus, the price is the actual market price buyers are willing to pay. Table 1 provides some descriptive statistics on realized prices.

TABLE 1

Descriptive statistics on prices

Variables	N	Mean	Median	Std Dev
Price (€) ► Hammer	793	6 090	1 500	21 731
► Buyer's premium incl.	793	7 633	1 877	26 587
► Per cm2	792	6,82	1,47	51,62

[4] Created in 2001, Bédéthèque© (https://www.bedetheque.com) is the website where the largest community of francophone *bande dessinée* connoisseurs meet. It includes tools for the management of comics collections and sales, an online forum about comics, contests, previews, news, specialized articles, online exhibitions, releases schedule, etc. This website gathers more than 100 000 subscribers, and records more than 290 000 comic books, 35 000 authors, 31 000 magazines, and 53 000 comic objects. It is the most complete comics database up to date.

We observe 793 prices, which means that on 1101 artworks, 308 are bought-in (28%). We observe that the mean price of an artwork in our sample is 7 633 € (*i.e.* 6,82 € per square centimetre) but the median price is much lower: 50% of artworks are sold under 1 877 € (*i.e.* under 1,47 € per square centimetre).

Regarding the exogenous variables, we distinguish three sets of explanatory factors used in our models. The first set of variables is about horizontal differentiation, *i.e.* physical attributes of the artwork that are differently appreciated by art consumers. They capture their tastes (section 3.2.1). The second set of variables deals with vertical differentiation: they are equally appreciated by art consumers and reflect the artwork's quality (section 3.2.2). Finally, a third set of variables gathers control variables (section 3.2.3).

3.2.1. Horizontal differentiation variables

Horizontal differentiation variables encompass the characteristics usually studied by the literature (hedonic approaches), which are physical attributes of the artwork. Table 2 displays descriptive statistics for such variables, as they are captured in this study.

TABLE 2

Descriptive statistics on horizontal differentiation variables

Variables	N	Mean	Median	Std Dev
Year	1 095	1 987	1 986	17,84
Size (m2)	1 100	0,18	0,14	0,22
Type (0/1) ► Boards/strips	1 101	0,58	1	0,49
► Coverpage	1 101	0,10	0	0,31
► Illustration	1 101	0,28	0	0,45
► Draft	1 101	0,03	0	0,17
► Coloring	1 101	0,01	0	0,08
Medium (0/1) ► Ink	1 101	0,81	1	0,39
► Paint	1 101	0,38	0	0,49
► Pencil	1 101	0,15	0	0,36
► Feltpen	1 101	0,04	0	0,19
► Pasting/mixedmedium	1 101	0,04	0	0,19
Subject matter (0/1) ► Action	1 101	0,20	0	0,40
► Ads	1 101	0,02	0	0,15
► Adventure/suspense	1 101	0,26	0	0,44
► Archetypes	1 101	0,22	0	0,41
► Arts	1 101	0,04	0	0,19
► Death	1 101	0,03	0	0,17
► Erotism	1 101	0,13	0	0,33
► Fantasy/Magic	1 101	0,11	0	0,31
► Genre	1 101	0,24	0	0,43
► Historical context	1 101	0,11	0	0,32
► Homage	1 101	0,04	0	0,18
► Humor	1 101	0,16	0	0,37
► Interaction	1 101	0,20	0	0,40
► Landscape	1 101	0,18	0	0,38
► Love	1 101	0,04	0	0,19
► Portrait	1 101	0,13	0	0,34
► Science-fiction/high-tech	1 101	0,09	0	0,28
► War/Violence	1 101	0,11	0	0,31
Color : Blackwhite (0/1)	1 101	0,69	1	0,46
Color : % of black	765	0,27	0,25	0,11
Composition : Staging effect	1 101	2,07	2	1,10
Composition : Speech bubbles	1 101	6,97	4	11,55
Composition : Number of panels	656	8,45	8	7,08
Composition : Page layout	656	0,82	1	0,96
Style	1 101	3,78	4,03	1,56

We first present the variables usually considered by the literature to capture horizontal differentiation between artworks. These variables are then completed by new horizontal differentiation variables that apply to original comics. The latter allow us to refine the analysis of features related to style, color, and composition. The appreciation – and therefore the valuation of these attributes – depends on art buyers whose tastes cannot converge towards a common ranking of the auctioned lots.

Hedonic studies frequently exploit five variables on art: the *year* of production, the *size*, the type of art, the medium, and the subject matter. We adapt these variables to comic art. Here, *size* variable is expressed in square meters. As original comics can be of different types, we included dummy variables for each type of artwork (*board*, *illustration*, *coverpage*, *draft* and *coloring*). Our sample consists of boards (58%), illustrations (28%), coverpages (10%), drafts (3%), and colorings (1%). The medium used is also tested through a set of dummy variables: *ink, paint* (including oil and watercolor), *pencil, feltpen*, and *pasting/mixed medium*. Comic artworks can combine various techniques. Ink is the most typical medium used for comics (81% of the sample concerned). We include a feltpen dummy (used for 4% of the sample) as this medium does not last and vanishes with time, so one can expect a negative impact on the probability of sale and/or auctioned price. The subject matter attribute has appeared in a few previous studies (Agnello and Pierce 1996, Onofri 2005, Campos and Barbosa 2008, Renneboog and Spaenjers 2011), which explored about 10 different topics, always with the same basics: landscape, portrait, religious, still life, genre, and figures. Based on a thorough observation of each artwork's image found in the pre-sale catalogues, we encompass a broader set of 18 subject matters: *action, ads, adventure, archetypes, arts, death, erotism, fantasy/magic, genre, historical context, homage, humor, interaction, landscape, love, portrait, science fiction/high-tech, and war/violence.* These are non-excludable as comic artworks often cover more than one single topic. The most frequent subject matters are adventure/suspense (26% of original comics), genre (24%) and archetypes (22%).

The next seven variables are original proxies of horizontal differentiation, related to *i)* color, *ii)* composition, *iii)* style. These variables have not been explored by the literature yet. According to Philip Hook, board member and senior director at Sotheby's in London, with 40 years of experience: "*what sells art*" is "*a matter of factors such as composition, color (blue and red tend to be good news) and emotional power*" (The Guardian, 18/11/2013).

As showed by Ma *et al.* (2019), color is a determinant of non-figurative paintings prices, especially red and blue that call for a premium. The role of color in purchasing behaviors has also been identified in the retail sector (Bellizzi and Hite 1992). We introduce here two original variables related to color: *i.e.* a simple dummy and a more sophisticated variable. We first consider a *blackwhite* dummy, taking the value of one for black and white original comics and zero for colored ones. Such distinction is needed as both types of artworks are commonly found on the comic art market, although black and white artworks represent two third of our sample.

The second variable coincides with the percentage of black (*% of black)* for black and white lots. To measure this value, we used the imaging software ImageJ© that provides the exact percentage of black in 8-bits transformed pictures. In average, a black and white comic contains 27% of black.

As for composition, we introduce four composition variables, according to the modalities, codes, and tools that an artist can use to create a comic page (Groensteen 2008). The first composition variable is the number of *speech bubbles* appearing in the artwork, a characteristic which is very specific to comic art. Indeed, a comic page can be more or less "talkative", that is filled in with bubbles containing the characters' words and/or context explanations. For instance, the artist Edgar P. Jacobs, author of *Blake and Mortimer*, is well-known for having created several of the most "talkative" boards (Groensteen 2008). A sampled original comic includes in average almost seven speech bubbles, but this number fluctuates greatly among original comics. The second and third composition variables are specific to boards. The second variable refers to the *number of panels* contained in a board, which is a critical choice made by the comic artist. Indeed, increasing the number of panels within a board makes them smaller and vice-versa. The third variable deals with the *page layout*. When designing a board, the artist can draw and organize panels in a variety of ways. The purpose of this variable is to investigate how an elaborate and original layout (compared to a simpler one) sells better/less for a higher/lower price. Measuring the complexity/originality of a layout requires to develop a precise analytical framework to avoid subjectivity. Following that purpose, we constructed a layout score which is the aggregated combination of eight layout dummies. Our reference point is the simplest layout, *i.e.* (1) containing square or rectangular panels, (2 and 3) entirely-framed panels, those being (4) clearly split on (5) one single board by (6) a white gutter[5], (7) no matter the symmetry, and (8) respecting the occidental[6] direction of reading. All eight dummies have null value if they correspond to the simplest layout. They take the value of one if: (1) the board holds at least one non-square/rectangular panel, (2) panels are non-framed, (3) panels are broken (the drawing goes out of the panel), (4) panels are nested, (5) panels stretch out over several boards, (6) there is no gutter or black gutter, (7) the board shows a sophisticated and notable symmetry, (8) the panels are organized in a way that does not follow the natural direction of reading. Overall, our aggregated *page layout* variable ranges from 0 (simple page layout) to 8 (elaborated page layout). Our sampled original comics has a median page layout score at 1, which means that the majority of artworks has a simple layout,

[5] On a comic board, a gutter is the empty space between panels.
[6] Contrary to Japanese manga, the direction of reading comics goes from left to right and from top to bottom.

while original layout is exceptional. The fourth and last composition variable refers to *staging effects*. Again, such complex variable on the staging effects intended by the artist requires a systematic protocol to remove subjectivity biases from the analysis. The intensity of the staging effects on a comic board can be measured through different channels: (1) a blurred effect, (2) a chiaroscuro effect, (3) a close-up, (4) a low/high-angle shot, (5) a panorama, and/or (6) a movement in composition. We built a binary variable for each of these staging effects, taking the value of one if the corresponding effect is observed on the board and zero otherwise. The *staging effect* variable stems from the sum of all six dummies. The corresponding score measures the importance of the staging effects. By construction, it lies between 0 (no staging effects) and 6 (important staging effects). The median staging effect score is 2, which means that authors commonly employ some staging effects.

Finally, the singularity of artworks – especially the artist's unique style – makes them fundamentally different from manufactured goods, especially when it comes to the question of pricing (Beckert and Rössel 2013). To account for this, we include in the sample a variable related to *style*. Comics are historically embedded in caricature, editorial-style cartoon, and humorous drawing (Groensteen 2008). In the last decades however, the number of realistic comics has increased steadily. Such duality of styles in the comics industry might have an impact on the way original comics are sold. Therefore, to describe entirely comic art style, one must analyze the caricatural *vs.* realistic aspect of the auctioned artworks. For obvious reasons, the *style* variable is the only one that was impossible to make completely objective. To construct it on the most objective way, we rely on a survey of 21 participants having a certain degree of expertise. Our surveyed panel includes comic collectors, comic connoisseurs, and people with artistic background (e.g., art history education or drawing and painting practice). We asked the participants to assess the 1101 artworks on a scale ranging from 0 (caricatural drawing style) to 10 (realist drawing style). The resulting *style* variable is a weighted average of the grades the participants attributed to our sampled artworks. The weighting varies with three skills that might affect the significance of their assessment: (1) their knowledge of comics, (2) their tendency to collect comics (e.g., original comics, books, and/or by-products), and (3) their know-how and knowledge in arts (drawing practice, art history studies). To assess these skills (and therefore endow each participant's grade with a weight), the surveyed persons had to answer a form gathering various questions. Regarding the knowledge of comics, each participant answered the two following statements (on a 0-10 scale): "*I know well the world of Bande dessinée in general*" and "*I appreciate the world of Bande dessinée*". Regarding comics collection habits, they answered three complementary statements (same scale): "*I collect comic original comics*",

"*I collect comic-books*", "*I collect comic objects/by-products*". Finally, regarding the participants' know-how and knowledge in arts, they answered two last statements (same scale): "*I practice(d) drawing and/or painting*" and "*I have an artistic education*". This survey was anonymous. 50% of sampled artworks have a weighted grade under 4, which means that most of them assume a caricatural drawing style.

It is undeniable that consumer's eyes are differently pleased by some artworks, depending on various criteria: size, medium, technique, subject matter, color, composition, and style. These attributes are considered by art buyers according to their taste and not regarding the quality *per se*, which is to be analyzed in the next section.

3.2.2. Vertical differentiation variables

This section introduces our *vertical differentiation variables*. Namely, we investigate six dimensions of vertical differentiation (*i.e.* quality as acknowledged by the comic art market). Three relate to the artist: *i)* reputation, *ii)* recognition, *iii)* his/her active part in the creation process (e.g., initial author, successor(s), or studio). The other three relate to the artwork: *i)* commercial and *ii)* critical success, *iii)* the number of heroes drawn in the artwork. Apart from the author's reputation and part in the creation process, all other variables are specific to our study and can be observed on the comic art market thanks to the hybrid nature of the goods traded on it. The descriptive statistics for these variables are presented in Table 3.

TABLE 3

Descriptive statistics on vertical differentiation variables

Variables	N	Mean	Median	Std Dev
Length of the biography	1 101	447,99	388	320,79
Artist's award (0/1)	1 101	0,20	0	0,40
Successor author (0/1)	1 101	0,10	0	0,30
Number of publications	1 101	3,82	2	6,97
Rating Amazon	452	4,34	4,5	0,66
Number of heroes	1 101	1,99	1	3,60
Ranking Amazon	638	438 602	257 279	490 064

The literature usually captures the artist's reputation by including his/her name as a dichotomic variable (Chanel 1995, Agnello and Pierce 1996, Higgs and Worthington 2005,

Marinelli and Palomba 2011). We did not opt for this approach since our sample contains hundreds of authors, which would have generated estimation issues. Following Renneboog and Spaenjers (2013), we choose an exogenous proxy of the artist's reputation which is the *length of his/her biography*, to capture the importance of the artist in the comic history. In practice, we recorded for each artist the number of words in their dedicated biography on the specialized comics' website Bédéthèque©.

Several awards are granted annually to comics authors to honor their lifetime achievements and career. For the Franco-Belgian comic artists, the most famous one is the *Grand Prix de la ville d'Angoulême* first given in 1974. For the American authors, equivalent awards are the *Will Eisner Comic Industry Awards* and the *Harvey Awards* (both first given in 1988). The existence of such unified and renowned distinctions, implemented for some decades now, allow us to test for the artist's recognition, in contrast to the old art markets that have many heterogeneous awards and prizes, which prevents comparison. Here, the *artist's award* variable equals one when the considered artist received one (or more) of the three quoted distinctions (for the Eisner and Harvey Prices, we considered the Best Artist Award), zero otherwise. In our sample, 20% of the artists received at least one of these awards. Receiving an award is a substantial recognition of the artist's work quality, therefore it is easy to rank the artists depending on this variable. Let us stress that having some non-European artists in our sample (3,6% of artworks are from American artists) is not an issue, as we consider a geographically homogeneous sales channel and market (*i.e.* France and Belgium).

Vertical differentiation also relates to the author's actual involvement during the creation process. In the comic industry, one must distinguish artists at the roots of the series (and of the most iconic characters) from those who are followers. Two categories of "followers" differ regarding the degree of artistic expression. First, one finds artworks done by the team members belonging to the studio of the main artist. Some authors like Hergé, Disney, Morris, and Vandersteen created studios in which they could delegate some tasks to their employees. The latter used to draw for them some parts of the boards and/or to finish their initial sketches. Studios' draftsmen in general do not have any freedom of artistic expression. Therefore, original comics from studios are done "in the manner of" the named author but not drawn by the artist him/herself. Consequently, their work ranks below those from the artist himself. Second, one finds artworks done by artists who are not behind the artistic and creative idea but who take over the work (*i.e.* the serie) initiated by the original artist. To account for this, we include a dummy variable *successor author* taking the value of one when the artwork is made by a follower, and zero otherwise.

Overall, the three previous variables capture quality at the artist level. We now present three other variables used to assess quality at the artwork level.

The first vertical differentiation variable related to the artwork for sale is the *number of publications, i.e.* the number of times the comic book from which the original comic artwork originates has been published. Indeed, reprints of a first edition mean that the comic book has been appreciated by the readers and that there is a demand for more copies. This variable assesses the commercial success of the comic book in which the artwork was published, which is a dimension of vertical differentiation. Using Bédéthèque© website, for each artwork for sale, we compute the number of publications, including the foreign language editions. On average, our sampled original comics have been published almost four times (3,82) before being auctioned.

We introduce a second variable accounting for critical success. To do so, we use some information from Amazon©, the world largest online bookstore to date. Amazon© gives their clients the possibility to rate the products sold on this platform by attributing a score from 1 to 5 stars. The critical acclaim of various comic books can be compared depending on the number of stars they received. Since comic artworks are most of the time part of a comic book, we consider the Amazon© clients' score as a relevant proxy of critical success. This corresponds to the *Rating Amazon* variable. When an auctioned artwork is not part of a comic book, we give a neutral score of three stars (a score under 3 reflects bad critics, while a score over 3 reflects good ones). Obviously, however, a five-star score given by one sole person does not have the same legitimacy than the same score given by 20 people. To account for this, we weight each Amazon© score by the number of scorers relative to the maximum number of scorers identified in our sample (79 scorers for the first comic book of the series *XIII* by William Vance). A similar scoring system was already used in another branch of the literature: Becerra *et al.* (2013) – on hotel pricing policies – considered the number of stars given by the guests as a vertical differentiation characteristic.

The third variable measuring the quality of artworks is the number of heroes drawn on them. The hero is a key and specific dimension of comic art, as for cinema or literature to some extent, in contrast to other art markets. A comic artist often becomes famous after his hero does so. From that view, the number of heroes is a systematic quality criterion as any comic art buyer would agree preferring a board displaying (once or more) the hero character than another without it. In order to capture this criterion, we count the number of famous heroes appearing in every auctioned lot. Our sampled artworks display almost two heroes on average (1,99). That

said, comic heroes are not identically famous. For instance, Tintin (by Hergé) is much more notorious than Signor Spaghetti (a hero created by Dino Attanasio). Comparing boards with heroes of different notoriety is certainly not equivalent for art buyers and collectors. To mitigate this effect, we weight the number of heroes by the Amazon© ranking of the album from which they originate. Indeed, books on Amazon© are subject to a global ranking depending on their commercial success. This weighting leads to our last variable accounting for vertical differentiation: *number of famous heroes*.

3.2.3. Control variables

We include five control variables in our analysis. Each may influence the probability of sale and/or the final auction price. One variable describes the sale environment, two account for the artist's output (supplied works), one relates to the attribution issues, and one last to the artworks' condition. Table 4 displays the corresponding descriptive statistics.

TABLE 4

Descriptive statistics on control variables

Variables	N	Mean	Median	Std Dev
Christies (0/1)	1 101	0,30	0	0,46
Death (0/1)	1 101	0,38	0	0,49
Number of works	1 101	47,38	38	38,20
Signature (0/1)	1 101	0,62	1	0,48
Condition (0/1)	1 101	0,07	0	0,26

We use a *Christies* dummy to describe the sale environment (equals one if Christie's auction house sells the lot, zero otherwise). This variable controls for the "auction house effect". Along with Sotheby's, Christie's is one of the world's major auction house and despite the law of one price, numerous published works demonstrated that they usually sell with a premium compared to other auction houses (Pesando 1993, De la Barre *et al*. (1994), Renneboog and Van Houtte (2002), Hodgson and Vorkink (2004), among others).

The boosting influence of the artist's death on prices has often been asserted (it was specifically studied by Ekelund *et al.* 2000, Maddison and Jul-Pedersen 2008, Ursprung and Wiermann 2011). This reflects a supply downturn in the artist's output which stops at death. Therefore, we include a *death* dummy, taking the value of one if the sale takes place after the artist's death (zero otherwise). Besides, due to the law of supply and demand, any factors

influencing the level of supply must be considered to explain prices. As the production of artworks strongly differs between comic artists, we build a variable counting the *number of works* created by each of them. To have this number, we use the information stemming from the artists' bibliography, available on Bédéthèque©.

Fakes are common on the art market. Actually, many authors investigated attribution issues on the art market (Agnello and Pierce 1996, Campos and Barbosa 2008, Renneboog and Spaenjers 2013). Comic art is no exception unfortunately. Yet, the prevalence of fake art is notably lower for the boards published in comic books: a simple comparison between the board and its published version makes it easy to distinguish originals from fakes.[7] That said, as for other artworks, the presence of the artist's signature is an additional proof of authenticity. We follow this path and consider a binary control variable accounting for the *signature* (equal to one if the artwork holds a signature, zero otherwise).

We finally control for the condition of the auctioned artworks, that several authors have pointed out as a significant factor affecting art prices (Anderson 1974, Agnello and Pierce 1996, Czujack 1997). That said, empirical works have frequently omitted cosmetic conditions from the analysis, as it requires collecting data by hand. Fortunately, as explained before, we could perform such collection while building our dataset. We construct a *condition* dummy variable, equal to one if the artwork is damaged (e.g., retouching, patches, tears, yellowing etc.), zero otherwise.

3.3. The model

The purpose of this study is to understand how horizontal/vertical differentiation can influence the likelihood of sale of auctioned original comics, and their price. The hedonic approach allows for this by focusing on the fundamental heterogeneity that characterizes differentiated goods. Usually, hedonic models consist in regressing artworks price (the dependent variable) on a range of features (the explanatory variables), which leads eventually to implicit prices. Nevertheless, most hedonic regressions found in the literature are subject to selection biases as they consider sold artworks only. Thus, the estimates may be biased due to non-randomness in the considered samples.

In practice, the probability of sale stems from the confrontation of the seller's and bidders' reserve prices. The auctioned lot gets sold if at least one of the latter outreaches the

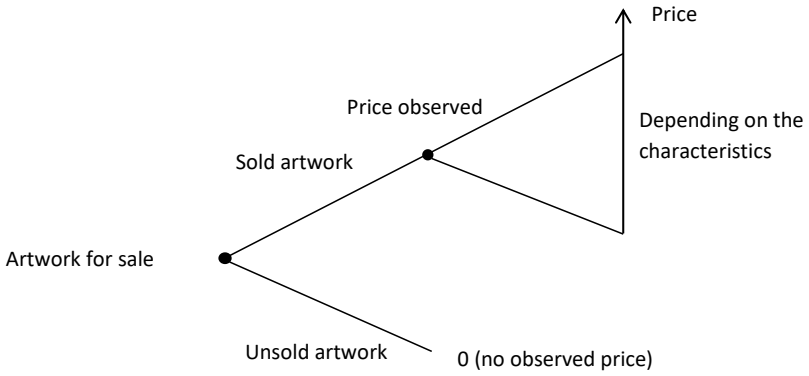
[7] The situation is more complex for autographed albums, where falsified items are much more frequent (Deneyer 2016). This does not affect our study however, as we exclude albums, books, and autographs from the sample.

seller's reserve price. In the opposite case, the lot is bought-in and remains the property of the seller. For the lots that are sold eventually, the final price depends on the valuations of both the seller and the bidders. The seller has an influence on this price by setting initially his/her reserve price, which determines a lower limit for acceptable bids. Above this limit – which remains the seller's private information –, bidders are free to (over)bid (provided they are at least two of them), setting therefore the upper limit of the price.

According to Artprice©, 30-40% of the lots being sold through standard auctions are left unsold. Excluding them from the analysis might generate serious selection bias, and thus inconsistent estimates, as it would leave the less desirable artworks behind. Our sample advantageously includes sold and unsold lots. Consequently, besides the observed price, we can explain the probability of sale too, thus going beyond the usual hedonic approaches. Technically, the dependent variable (*i.e.* the price) is left-censored, since it does not exist for artworks for which the bids are below a certain threshold (*i.e.* the seller's reserve price). Figure 1 illustrates the overall auction sale process.

FIGURE 1

The auction sale process of an artwork (censored dependent variable)



Tobit models are designed frameworks for censored dependent variables. The Tobit technique allows to include all the sampled observations, below and above the threshold (*i.e.* the seller's reserve price). Type II Tobit models apply here, since the latent variable does not assimilate to the observed dependent variable. Therefore, the probability of sale and the sale price are independent. Our Type II Tobit model follows:

$$y_{2,i} = \begin{cases} y_{2,i}^* & if\ y_{1,i}^* > 0 \\ 0 & if\ y_{1,i}^* \leq 0 \end{cases} \quad (1)$$

$$y_{1,i}^* = x_{1,i}\beta_1 + \varepsilon_{1,i} \quad (2)$$

$$y_{2,i}^* = x_{2,i}\beta_2 + \varepsilon_{2,i} \quad (3)$$

Where: $i = 1, \ldots, N$ denote each lot with N the sample size,

$x_{j,i} = \left(x_{j,i}^1 \ \ldots \ x_{j,i}^{K_j} \right), j = 1, 2$, are two vectors of observed artwork characteristics,

$\beta_j = \left(\beta_{j,1} \ \ldots \ \beta_{j,K_j} \right) \in \mathrm{R}^{K_j}, j = 1,2$, are two vectors of unknown coefficients.

The random disturbances $\varepsilon_{j,i}$ are normally distributed with zero mean and constant variance, σ_j^2 $(j = 1,2)$. $y_{1,i}^*$ is the latent variable which is positive if the last bid exceeds the seller's reserve price, and negative otherwise. The dependent variable $y_{2,i}$ is the (logged) auction price, only observable if $y_{1,i}^*$ is positive, that is when the lot is sold. It is not possible to observe the value of the latent variable but only a binary variable sold/unsold. The variables $x_{j,i}$ are observed for each item, no matter if it is sold or not. The parameters of the Tobit II model are estimated with the maximum likelihood method. We run three regressions. The first one covers the entire sample (Model 1, N=1101). The second one focuses exclusively on boards (Model 2, N=637), as those are the main comic art type. The third one aims black and white artworks (Model 3, N=764), more frequent than colored ones. In every regression, two equations are estimated: one for the probability of sale, the other for the price.

4. Results

This section presents our estimated results. The corresponding findings are to be discussed in the subsequent section. Table 5 shows our three models. The related regression statistics are gathered in Table 6 (in the Appendix). The dependent variables are twofold: *i)* the probability of sale, *ii)* the auction (log) price, buyer's premium included. Overall, multicollinearity does not affect our regressions as no variance inflation score (VIF) exceeds 4,4 for any explanatory variables of any model. The mean VIF-scores are respectively 1,56, 1,40, 1,50 for the first, second, and third regression. Two explanatory variables have been excluded from the analysis: the *year* of production, which is multicollinear with many other variables, and the *number of artists' works*, highly correlated with the variable *artist's*

reputation. Indeed, the number of works relates to the artist's reputation. As publishing is expensive, an editor is willing to publish an artist's work only if it believes the comic has a chance to sell well.

Model 1 encompasses all the auctioned lots[8] and includes the entire set of explanatory variables but three: one variable related to color (*percentage of black*) and two related to boards (*number of panels* and *page layout*). The latter variables are to be analyzed more specifically in models 2 and 3 (see hereafter). Regarding our categorical variables, we set as respective benchmarks "*boards*" and "*ink*" for the dummies accounting for comic type and medium. Both categories are the foremost type and medium for comic art. In addition, we consider two other models on more homogeneous subsamples. Model 2 restricts to comic boards (thus excluding illustrations, covers, and drawings). Those are the main comic outputs actually, and have unique particularities (we thus added two variables about the panels showed in the boards). We withdraw the categorical topics "*ads*" and "*portrait*" since no board is concerned by them: contrary to illustrations and covers, a board cannot be an advert or a portrait. Our *size* variable was removed from that model since most boards are close in size due to edition standards. Model 3 includes black and white (B&W) comic artworks only. This latter model focuses notably on the *percentage of black* in the lots (here, these are of all types: e.g., B&W boards, illustrations, covers, and drawings). Obviously, estimating this model requires to remove the *coloring* variable.

Section 4.1 hereafter summarizes and interprets our estimates for models 1-3, displayed in Table 5. Robustness checks are then discussed in section 4.2.

[8] One observation is withdrawn from the original sample due to a missing *size* that was not reported in the pre-sale catalogue.

TABLE 5

Tobit Regressions

Variables	**Model 1: All lots included , N=1100**		**Model 2: Boards lots, N=637**		**Model 3: Black and white lots, N=764**	
	Equation 1 Dependant var.: probability of sale	**Equation 2** Dependant var.: *log* (sale price)	**Equation 1** Dependant var.: probability of sale	**Equation 2** Dependant var.: *log* (sale price)	**Equation 1** Dependant var.: probability of sale	**Equation 2** Dependant var.: *log* (sale price)
Horizontal differentiation variables						
Size (m2)	0,007	0,425 ***			-0,088	0,417 ***
Type (0/1) ► Coverpage	-0,343 *	0,759 ***			-0,219	0,757 ***
► Illustration	-0,395 **	0,678 ***			-0,446 *	0,616 ***
► Draft	-0,118	-0,502 **			-0,041	-0,491 *
► Coloring	0,449	-2,479 ***				
Medium (0/1) ► Paint	0,311 **	0,500 ***	0,384 **	0,485 ***	0,307 *	0,441 ***
► Pencil	-0,004	0,305 ***	0,212	0,069	0,230	0,282 **
► Feltpen	0,282	0,033	-0,162	0,253	0,092	0,195
► Pasting/mixedmedium	0,167	0,278	0,504	0,947 ***	-0,032	0,612 **
Subject matter (0/1) ► Action	0,195	0,145	0,238 *	-0,053	0,178	0,120
► Ads	0,131	0,024			0,236 *	-0,030
► Adventure/suspense	0,579 *	0,029	0,148	-0,048	0,434	-0,212
► Archetypes	0,172	0,233 **	0,199	0,133	0,157	0,136
► Arts	0,464 *	0,578 ***	0,531	0,659 **	0,455	0,499 **
► Death	0,011	0,105	-0,102	-0,063	0,090	-0,042
► Erotism	0,329 **	0,094	0,228	0,108	0,112	0,130
► Fantasy/Magic	-0,017	0,237 *	0,130	0,248	-0,087	0,065
► Genre	0,257 **	0,249 **	0,285 *	0,356 **	0,320 **	0,145
► Historical context	0,000	-0,029	0,100	-0,031	0,182	-0,159
► Homage	0,432 *	0,280	-0,158	0,123	0,159	0,181
► Humor	0,259 *	0,075	0,502 **	-0,014	0,367 **	0,130
► Interaction	0,077	0,171	0,126	0,028	0,072	0,215 *
► Landscape	0,322 ***	0,194 *	0,374 **	0,161	0,356 **	0,211
► Love	0,519 **	0,166	0,755 **	0,178	0,406	0,217
► Portrait	0,532 ***	0,118			0,436 *	-0,045
► Science-fiction/high-tech	0,311 *	0,173	0,238	0,404 **	0,249	0,027
► War/Violence	-0,009	0,016	0,290 *	-0,039	0,007	0,048
Color : Blackwhite (0/1)	0,411 ***	0,156	0,613 ***	0,538 ***		
Color : % of black					1,156 **	0,945 **
Composition : Staging effect	-0,069	-0,011	-0,143 **	0,057	-0,124 *	-0,018
Composition : Speech bubbles	-0,192 ***	-0,096	-0,229 **	-0,059	-0,156 *	-0,156 **
Composition : Number of panels			-0,008	0,205 *		
Composition : Page layout			-0,102 *	0,082		
Style	-0,106 ***	-0,042	-0,038	0,053	-0,082 *	-0,024
Vertical differentiation variables						
Length of the biography	0,018	0,147 ***	0,110 *	0,105 *	0,159 ***	0,092
Artist's Award (0/1)	0,098	0,724 ***	0,360 **	0,674 ***	0,135	0,795 ***
Successor author (0/1)	0,090	-0,235 *	-0,002	-0,185	0,026	-0,110
Number of publications	0,105	0,395 ***	0,073	0,445 ***	0,129	0,406 ***
Rating Amazon	0,533	0,663 **	0,673	0,982 **	0,753	0,448
Number of famous heroes	0,030	0,317 ***	0,057	0,313 ***	-0,012	0,387 ***
Control variables						
Christies (0/1)	-0,023	1,603 ***	-0,263 *	1,668 ***	-0,144	1,543 ***
Death (0/1)	0,129	0,112	0,017	0,207 *	0,040	0,205 *
Signature (0/1)	-0,065	0,036	-0,191	0,159	-0,134	0,089
Condition (0/1)	-0,052	0,067	-0,067	0,070	-0,177	0,124
Constant	0,385	5,814 ***	-0,225	3,814 ***	-0,517	6,152 ***

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level.

4.1.Differentiation, sales, and prices

This section analyzes the estimated influence of vertical and horizontal differentiation on the probability of sale (equation 1) and on the final auction price (equation 2). Figure 2 facilitates the reading of the results shown in Table 5, by categorizing the horizontal/vertical differentiation variables that are significant in models 1 to 3. For example, in Table 5, model 1 shows that *size* (horizontal differentiation variable) significantly influences the price (equation 2) but does explain the probability of sale (equation 1). Therefore, in row 1 of Fig. 2 (model 1), *size* appears in column 3 but not in column 1, and so on.

FIGURE 2

Significant variables by types of differentiation (equations 1 and 2)

	Probability of sale (equation 1)		**Price (equation 2)**	
	Horizontal differentiation variables	**Vertical differentiation variables**	**Horizontal differentiation variables**	**Vertical differentiation variables**
Model 1: All lots	**Type** (coverpage, illustration) **Medium** (paint) **Subject matter** (adventure/suspense, arts, erotism, genre homage, humor, landscape, love, portrait, science-fiction/ high-tech) **Color: black & white** **Composition:** **Speech bubbles** **Style**		**Size** **Type** (coverpage, illustration, draft, coloring) **Medium** (paint, pencil) **Subject matter** (archetypes, arts, fantasy/magic, genre, landscape)	**Length of the biography** **Artist's award** **Successor author** **Number of publications** **Rating Amazon©** **Number of famous heroes**
Model 2: Boards	**Medium** (paint) **Subject matte**r (action, genre, humor, landscape, love, war/violence) **Color: black & white** **Composition:** **Staging effect** **Speech bubbles** **Page layout**	**Length of the biography** **Artist's award**	**Medium** (paint, pasting / mixed medium) **Subject matter** (arts, genre, science-fiction/high-tech) **Color: black & white** **Composition:** **Number of panels**	**Length of the biography** **Artist's award** **Number of publications** **Rating Amazon©** **Number of famous heroes**
Model 3: Black and white artworks	**Type** (illustration) **Medium** (paint) **Subject matte**r (ads, genre, humor, landscape, portrait) **Color: % of black** **Composition:** **Staging effect** **Speech bubbles** **Style**	**Length of the biography**	**Size** **Type** (coverpage, illustration, draft) **Medium** (paint, pencil, pasting / mixed medium) **Subject matter** (arts, interaction) **Color: % of black** **Composition:** **Speech bubbles**	**Artist's award** **Number of publications** **Number of famous heroes**

The next subsections analyze the content of Figure 2 (out of Table 5) and investigate how far horizontal differentiation (4.1.1) and vertical differentiation (4.1.2) influence sales and prices.

4.1.1. Influence of horizontal differentiation

Three alternate cases can prevail regarding the influence of horizontal differentiation. (*i.e.* tastes) on the probability of sale. Firstly, comic art collectors may have common inclinations for some artworks' characteristics (physical and artistic attributes), so that one would expect a positive influence of such horizontal features upon sales (positive consensus). Secondly, most collectors may have common aversions for some other horizontal features, which would lead to a negative impact of these features upon sales (negative consensus). Thirdly, the high number of participants on the comic art market may generate a huge range of tastes, and thus prevent consensus about some horizontal features. Heterogeneous preferences (*i.e.* dissensus of tastes among the market participants) are then likely to compensate each other, and one would observe no significant impact of the concerned features on the probability of sale.

With respect to the relation between horizontal differentiation and the price, similar mechanisms are at stake. Indeed, depending on their tastes, consumers do not value identically some horizontal features, but their valuations may be close in case of dominant consumers inclinations or aversions, thus affecting positively or negatively the price, respectively. The literature has shown that several horizontal differentiation variables call for a premium, such as size, medium, subject matter, and color.

Our estimates in Model 1 (Table 5 and Fig. 2) indicate that the collectors' tastes follow interesting guidelines that generate consensus (positive or negative) on a subset of horizontal features, thus impacting sales and prices. We discuss here these features that are inherent in comic art. They shall be analyzed more thoroughly in section 5 that compares original comics market to other segments of the art market.

Model 1 confirms a trait commonly observed on other segments of the art market: the bigger artworks are, the more expensive. Yet, the correlations are more complex regarding the art type and medium, as both features exert mixed influences on sales and prices. Coverpages and illustrations sell less but are more expensive, which seems logical as both are scarcer (one coverpage per album in general), more aesthetic and/or emblematic of a comic serie. That said,

illustrations have lower chances to sell (also in Model 3) as purist collectors tend to avoid them: from a narrative perspective indeed, illustrations are less interesting than boards. At the opposite, drafts and coloring sell for a significant lower price. Such consensus among collectors is not surprising as both types of art are preliminary and incomplete works that call for a discount. The medium is not neutral either: painted (for all models) and pencil works (compared to inked originals, our reference category) are more valued by the market. In the comic industry, pencilers and inkers may be distinct artists (this is even more systematic in the US). In practice, while the workload increases with success, the initiator of a serie (as Hergé or Uderzo for example) can delegate inking to other artists, so that pencil artworks reflect more the essence of their work. Turning to subject matters now, whatever the considered equation in the three models (*eq.1*: probability of sale, *eq.2:* prices), we find that the various subject matters always generate, either dissensus among the market participants (*i.e.* no significance) or positive consensus among them.[1] The most striking finding is that no subject matter generates common dislikes (*i.e.* negative consensus). In other words, subject matters represented in original comics never generate collective rejection. Last, we consider the estimates on composition, style and color. All models show that talkative comic pages decrease the chances to sell the lot. This is not surprising as most of the connoisseurs of this market consider that talkative boards are less interesting esthetically (Deneyer 2016). As for boards (Model 2), a higher number of panels boosts the price, meaning that collectors prefer the traditional board with many panels than the modern one with less and bigger panels. The negative influence of realism on sales is remarkable in Models 1 and 3 as comics are historically rooted in the cartoonist movement (Groensteen 2008). Our estimates confirm that caricatural works have still the preference of comic art buyers. For close reasons, black and white works sell better than colored ones since B&W productions are fundamental to comics culture. We also find that, *ceteris paribus*, the higher the percentage of black in B&W artworks (Model 3), the higher the price.

4.1.2. Influence of vertical differentiation

We analyze here the impact of vertical differentiation on the probability of sale. Let us consider, for an auctioned lot, a marginal increase of a variable accounting for quality (for instance, one more hero appearing on a board[2]). Three situations (or scenarios) can arise from

[1] Namely, in the latter case, the chances of sale and/or the price elevate with the following subset of subject matters (Model 1): *adventure/suspense, archetypes, arts, erotism, fantasy/magic, genre, homage, humor, landscape, love, portrait, science-fiction*.
[2] A similar analysis could be made by comparing two lots of different quality.

improved quality. Under scenario 1, the seller may value such increase more than the bidders, therefore his reserve price marginally elevates more than the bidders' ones: *ceteris paribus*, the chances to sell the lot decrease. This would result from greedy behavior by the seller or some overconfidence on the way quality is valued by the market, which has been subject to notable speculation since the 2000s (Deneyer 2016). Here, one would expect vertical differentiation variables to have a negative influence on the probability of sale. But the reverse may occur too: under scenario 2, the buyers may overvalue the rise of quality compared to the seller. This would reflect some excitement among art buyers. Marginally, their reserve prices elevate more than for the seller. Under this scenario – contrary to the previous one –, vertical differentiation variables should boost the probability of sale. Scenario 3 supposes that the two previous effects compensate each other, so that there is no significant impact of the increase in quality upon sales.

Regarding the previous considerations, Figure 2 (out of Table 5) drives a striking finding. Indeed, one can notice that a cell in Fig. 2 is totally empty. Namely, in the selection stage of model 1, *none of the variable accounting for vertical differentiation significantly influences the probability of sale*.

This finding suggests that better quality does not always lead to prevailing overvaluations by the sellers compared to the bidders (scenario 1), as we do not observe a negative impact of vertical differentiation upon sales. Nor does this imply dominant overvaluations on the bid side (scenario 2), as we do not observe a positive impact on the outcome of transactions. Overall, we do not find any significant influence of vertical differentiation variables upon sales. This suggests that overvaluations from one by another (sellers and bidders) compensate each other. Sometimes the sellers overvalue quality compared to the buyers, some other times it is the other way around. *Ceteris paribus*, comic artworks of high-quality (as captured by our proxies of vertical differentiation) do not produce homogeneity of behaviors but rather heterogeneity across the market, as a mix of greed, overconfidence, and excitement altogether (scenario 3). One might argue however that, in some specific cases, a rise of quality may be equally valued by both ask and bid sides, so that the respective reserve prices adjust in the exact same proportion, and the probability of sale remains unchanged. In our view however, this latter scenario is less likely to be observed systematically on all the auctioned works.

Models 2 and 3 – that focus on more homogeneous lots (*i.e.* boards and B&W artworks) – confirm to some extent the previous finding, since only two and one proxies of quality are significant in each model respectively (see column 2 in figure 2). Specifically, both

models show that the artist's reputation (*length of the biography*) significantly increases the chances to sell the associated lots. Marginally speaking and according to the previous scenarios, it indicates that, for both types of artworks, buyers overvalue those of reputed artists, more than the seller does. In model 3 (that restricts to boards), buyers also overvalue the artistic recognition (*artist's award*). Therefore, only quality that relates to the artists – if any – matters in determining the probability that their works get sold. But, except from these two variables, all other vertical differentiation variables – especially those related to the artworks themselves – do not play any relevant role in the sale, which in a nutshell, confirms the prevalence of scenario 3.

Let us consider now the relation between vertical differentiation and price. This relation is more straightforward to analyze. Let us consider once again a marginal increase in quality of some auctioned lots. Remind that prices are observable for sold items only, *i.e.* when the buyers' bids outreach the seller's reserve price. In that case, it is most likely that all the market participants increase their valuation, as it would be an economic non-sense that better quality leads to an equal/lower price. Therefore, for lots that get sold eventually (*i.e.* for which a price is observed), the price is expected to rise with quality, which is a common feature of vertically differentiated markets (Lancaster 1966).

This expectation is confirmed by Table 5 and Figure 2. Most of the proxies of vertical differentiation have a very significant influence (at the 1% level) on prices. First, the three quality-variables that relates to the artist's acknowledged reputation, recognition, and role in the creative process, contribute positively to the final observed price (actually, "negatively" for the dummy variable testing for the role in the creative process, since a "follower role" was coded 1 and the "main role" 0). Second, the three quality-variables accounting for the artwork's quality – *i.e.* its commercial and critical successes, and the number of heroes – also call for a premium.

4.2.Robustness checks

Models 2 and 3 serve as two primer robustness checks of Model 1. Indeed, both models apply on smaller samples and test for the scope of our results on more homogeneous artworks, namely *i)* boards and *ii)* black and white artworks. In addition to such sample reduction, certain explanatory variables are added to and withdrawn from the original regression (Model 1). Overall, Models 2 and 3 corroborate the results found on the entire sample.

We proceed to a third robustness test to check the sensitivity of our results to outliers. For this purpose, we run a regression that restricts to the top 50% of the artworks with the highest average estimations, in our case above an average estimation of 1 250 €. Indeed, the estimation given by the auction house is most of the time a price range, that is why we take the average estimation of this range. For this regression, all explanatory variables used for Model 1 (entire sample) are kept, but the *coloring* variable, since no sampled coloring is estimated above the 1 250 € threshold. Splitting in half the sample – between the low-end and the high-end segments – does not change the results found on the entire sample. As for Model 1, we still observe that none of the vertical differentiation variables influences the probability of sale, but the same variables have significant effect on prices. This indicates that our results are consistent and robust to outliers. The results of the corresponding regression can be found in Table 7, in the Appendix.

5. Discussion

Comic art is still a young market. In relation with the previous results, this section questions how far this market assimilates to other art market segments, which then would allow for some generalization of our findings. For that, we look whether our results on comics auctions follow (or differ from) the rationale that usually drives art markets, as identified by the literature. This amounts to assess the factors that comic art collectors value the most, and if these are like those prevailing on other art markets. We develop below such comparative approach and group the factors that determine the most the probability of sale, at first, and the price, at second. These factors are classified depending on their similarity with art markets in general, or at the opposite, on their specificities to comic art.

Similarities between both markets are quite numerous. First, the unsold rate on our sample (28%) is close to the one prevailing on the global art market (34% on average in 2017, Artprice©). Next, three determinants of prices found significant in our estimates (*i.e.* size, medium, and subject matter) have been proved essential for a while in the literature. As for size, our results corroborate previous findings on other art markets, as the price increases with size on the comic art market (Anderson 1974). Supporting Ekelund *et al.* (1998)'s finding on the Latin-American art market, size has however no significant impact on the probability of sale. Concerning the medium, paint (which includes oil and watercolor in our data) carries significantly and somewhat surprisingly higher prices, alike the traditional painting markets where oil is the most desirable media because of its durability and complex mastering (Agnello

and Pierce 1996, Renneboog and Van Houtte 2002, Worthington and Higgs 2005). Paint also increases the probability of sale, as suggested for watercolor in Campos and Barbosa's study (2008). At first sight, this is rather unexpected for original comics, as paint generally arrives at the end of the comic creative process and can be handled by someone else. At second sight however, this can be explained by the fact that – for colored lots – direct coloring is more sought after than digital painting, as this latter technique undermines the uniqueness of the work. Aside colored artworks, many are done exclusively with pencil or ink (69% in our sample), showing evidence that the corresponding artworks hold the totality of the creative process without being colored. With respect to the topic, some subject matters (like archetypes, genre, or landscape) have a significant influence on comic art prices, corroborating the importance of subject matters, as highlighted by previous studies on other art markets (Agnello and Pierce 1996, Campos and Barbosa 2008, Onofri 2009, Renneboog and Spaenjers 2013).

Another typical determinant of price established by the literature relates to the artist, beyond the sole artwork's attributes. As explained before, data accounting for the artist are unfortunately coarse in the literature, as most studies restrict to the artist's reputation. Thus, this latter dimension found in the literature is the single one that our study can compare with. Despite this limitation, our estimates on original comics confirm the positive and significant impact of the artist's reputation (proxied by *length of biography*) on prices.

Furthermore, our control variables used on original comics drive similar results than other investigations on the art market. Namely, we find that comic artworks sold by Christies command significantly higher prices, as recurrently highlighted in the literature (Pesando 1993, Worthington and Higgs 2005, Marinelli and Palomba 2011, Renneboog and Spaenjers 2013). The artist death dummy also exerts a positive influence on prices (Models 2 and 3) as identified by Buelens and Ginsburgh (1993), Ekelund *et al.* (2000), Worthington and Higgs (2005), Ursprung and Wiermann (2011). Turning to the probability of sale now, we find that the lots auctioned by Christie's have same (Models 1 and 3) or lower (Model 2) chances to sell than with other auction houses. We can see a similar effect for artworks' types: coverpages and illustrations call for a premium on price but also for a lower probability of sale. Overall, this suggests indirectly that, on the comic art market, what is more expensive is harder to sell. This would be another evidence that the "masterpiece effect" might not hold, corroborating results from Mei and Moses (2002), Pesando and Shum (2008), among others. This latter effect is the common belief that the most expensive artworks outperform the market.

From the previous discussion, we can conclude that comic art market shares common traits with the art market in general, and therefore some of our results may extend to other art segments. However, this recent market has its own specificities, that we discuss hereafter.

We now discuss our findings that are specific to the comic art market. We first consider the comic type. Illustrations and coverpages, despite their lower probability of sale, lead to a premium on price in comparison with boards. As suggested before, the law of supply and demand explains this, as coverpages are scarce (one for a comic book) whereas there are tens of boards. Besides, a coverpage is often one big drawing striving to reveal the general theme of the comic book, contrary to a board that is one piece of the global story. Therefore, covers are often viewed by collectors as the synthesis of a serie (Groensteen 2008). Regarding illustrations, their positive influence on prices was *ex-ante* unexpected since they are not part of a comic book. But this result reinforces *ex-post* our explanation on coverpages: some art buyers prefer to acquire one big drawing that tells about the story more than a simple board that remains an incomplete excerpt of the comic book. One may also argue that coverpages and illustrations are a better answer to the domestic decoration motive than boards. Regarding drafts and colorings, they achieve lower prices than boards, as one could expect. Drafts are unachieved artworks and colorings do not hold the creative hand drawing process as it is a print of the original comic on which colors are added by hand. With regard to medium, paint not only carries higher prices, but also higher chances of sale in comparison with ink (all models). Our estimates show that pencil is priced higher too. Again, it is likely that comic art buyers value the pencil medium because it is the mark of the artistic work process, despite a relative durability. Last, despite being less durable over time, feltpen does not have any significant impact on sale rates or prices.

Some subject matters are not equally valued by comic collectors (see *supra*), but our study reveals that some of them influence the probability of sale too. On this market, we observe that twice more subject matters have a significant influence on sales than on prices. Namely, on models 1-3 altogether, all the topics but five (*archetypes, death, fantasy/magic, historical context, interaction*) are associated with a higher probability of sale. Seven topics only boost the price eventually: *archetypes, arts, fantasy/magic, genre, interaction, landscape, science-fiction*. These results show that comic art collectors value traditional topic shared with other art markets such as genre, portrait, or landscape, but also specific topics anchored in comics culture such as action, archetypes, fantasy/magic, humor or science fiction. Lastly, it is worth noting that even if erotic comics could be considered as the most well-known branch of comic art, this topic only has a higher probability of sale, but does not call for a premium.

We discuss at last the impact of the factors newly introduced for this research. We first address the influence of colors. Ma *et al.* (2019) identified that blue and red call for a premium in non-figurative paintings. Let us transpose this question to comic artworks and discuss the influence of color *vs.* black and white. Our estimates on the comic art market show the adverse influence of colored lots on sales (Model 1). Colors also deflate prices when focusing on boards (Model 2). The inclination to B&W lots is certainly a key feature of the comic art market (see *supra*), simply because most comic artists work in black and white, so that the corresponding artworks reflect comics culture more. Besides, as stated by Philip Hook (The Guardian, 18/11/2013), but not explored in the literature yet, we find that composition has a notable impact on the outcome of transactions. As expected, the more speech bubbles, the lower the probability of sale (Models 1 and 2). Indeed, the space used by text inevitably overshadows the drawing and undermines aesthetics, to the regret of art buyers. Another important finding stems from Model 2 that restricts to boards. Our estimates suggest that buyers remain committed to more traditional comic art, *i.e.* boards with less staging effects, simpler page layout (both variables decrease sales) and more numerous panels (positive influence on price), which contrasts with more recent comic productions, often sophisticated and with fewer panels (Deneyer 2016). Overall, this general preference for traditional comic style is confirmed in Models 1 and 3 showing that caricatural style has a higher probability to sell *vis-à-vis* realist style. Last, as mentioned before, the artist's recognition (*artist's award*), artworks' commercial and critical successes (*number of publications* and *rating Amazon*) lead to significantly higher prices, *ceteris paribus*. Also, the more famous heroes the artwork holds, the higher the price. However, artworks by followers unsurprisingly fetch lower prices than those by the main artist.

Throughout this analysis, we can conclude that the comic art market value many factors identical to those commonly appreciated on art markets, which suggest that our findings could be generalizable to other art segments. That said, our results also carry notable specificities that relates to the distinctive history of comics.

6. Conclusion

While the literature has mostly focused on the determinants of art prices related to tastes (horizontal approach), sale environment, and/or attribution issues, our study originally considers determinants accounting for acknowledged quality (vertical differentiation). This

latter dimension is particularly important in art markets that suffer from quality uncertainty and information asymmetries.

This paper explores a hand-collected dataset of 1101 original comics auctioned between March 2017 and May 2018. It brings to the literature a missing class of vertical differentiation variables encompassing the artist's reputation, recognition and artistic involvement, the artworks' commercial and critical successes, and the representation of heroes as a fundamental element of comics. Besides, we broaden the set of horizontal differentiation variables (*i.e.* physical attributes) explored so far by hedonic pricing models. Namely, our study incorporates original horizontal features related to color (black and white, percentage of black), composition (staging effect, speech bubbles, panels, page layout), and style (degree of realism). We also get rid of the selection bias commonly found in the literature by including unsold artworks in the analysis. To this end, we estimate Tobit II models, allowing us to explore the price determinants *and* the probability of sale. Finally, our study helps in investigating a new segment of the art market, *i.e.* the comic art market, where the traded goods are basically of hybrid nature, which enables us to understand better vertical differentiation on this market.

We find that vertical differentiation contributes to heterogeneous behaviors regarding transactions. Due to various psychological traits (greed, overconfidence, or excitement about quality), comic art sellers sometimes overvalue their artwork compared to the buyers while the reverse occurs some other times. Overall, the behaviors of market participants appear to compensate so that in the end, quality does not change the probability of sale. This general result still holds on more homogeneous subsamples (*i.e.* boards, black and white artworks), except for quality-related variables on the artist that increase sales eventually. In contrast, better quality leads logically to a premium: on the full sample, all the variables accounting for quality exert a positive impact on prices. Regarding horizontal differentiation now, some horizontal features have a steady influence on sales and prices. This finding suggests that individual tastes about physical and artistic attributes do not always compensate each other: on the contrary, mutual preferences, trends, and fashion play a definitive role in comic art auctions, so that tastes shared by the majority lead to common inclinations and aversions.

When questioning the generality of our results, we find that comic art market has many similarities with traditional painting markets. Size, medium, subject matters, auction channels, artist's reputation/death, have an impact on prices, as highlighted by the literature on other art markets. At the same time, comic art market keeps its specificities linked to the nature of comic art. Covers and illustration call for a premium but have lower probability to sale (compared to boards), when colorings and drafts have a negative impact on prices. Pencil medium commands

higher prices as a sign of the artist's creative process. While comic art consumer value traditional topics (landscape, portrait, genre), they also value emblematic comic subject matters such as action, archetypes or humor. Black and white artworks sell better than colored lots (and command higher prices for boards). The higher the percentage of black in B&W artworks, the higher the probability to sell them with a premium. Last, our study on European comic auctions show that collectors are inclined to more traditional comic art, with fewer staging effects, simpler layout, more panels and heroes.

This study sheds original light on many horizontal/vertical determinants of sales and prices of comic artworks. Both are the results of bid and ask valuations. Therefore, additional data on bidders' characteristics would allow to infer consumer preferences and behaviors. Studying the way sales are settled by the various auction houses would also open a promising avenue for research on price determinants.

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Appendix

TABLE 6

Regression statistics

	Model 1 (entire sample)	**Model 2 (boards only)**	**Model 3 (black and white artworks only)**	**Robustness test**
Number of Observations	1100	656	764	550
Missing Values	1	1	1	0
Number of endogeneous variables	2	2	2	2
Censored observations	308	183	205	148
Censored observations (%)	0,28	0,28	0,27	0,27
Log Likelihood	-1702	-1001	-1159	-720,37
Optimization Method	Quasi-Newton	Quasi-Newton	Quasi-Newton	Quasi-Newton
AIC	3575	2153	2487	1609
Schwarz Criterion	4006	2494	2877	1971

TABLE 7

Robustness test - excluding artworks with average estimation below 1 250 € (N=550)

Variables	**Equation 1** **Dependant var.: probability of sale**	**Equation 2** **Dependant var.: *log* (sale price)**
Horizontal differentiation variables		
Size (m2)	0.171 *	0.216 ***
Type (0/1) ► Coverpage	-0.607 **	0.394 **
► Illustration	-0.830 ***	0.726 ***
► Draft	-0.760	0.275
► Coloring		
Medium (0/1) ► Paint	0.342 *	0.367 ***
► Pencil	0.009	0.238 **
► Feltpen	0.464	0.134
► Pasting/mixedmedium	0.014	0.275
Subject matter (0/1) ► Action	0.160	0.118
► Ads	0.066	0.097
► Adventure/suspense	0.162	0.216
► Archetypes	0.183	0.148
► Arts	0.511 *	0.214
► Death	-0.053	-0.239
► Erotism	0.199	0.192 *
► Fantasy/Magic	-0.102	0.194
► Genre	0.080	0.147
► Historical context	-0.004	-0.059
► Homage	0.461	0.197
► Humor	0.181	-0.011
► Interaction	0.196	0.001
► Landscape	0.240	0.009
► Love	1.380 ***	-0.001
► Portrait	0.692 ***	0.006
► Science-fiction/high-tech	0.370 *	-0.124
► War/Violence	-0.187	-0.101
Color : Blackwhite (0/1)	0.612 ***	-0.099
Color : % of black		
Composition : Staging effect	-0.123 *	-0.004
Composition : Speech bubbles	-0.422 ***	-0.009
Composition : Number of panels		
Composition : Page layout		
Style	-0.091	-0.005
Vertical differentiation variables		
Length of the biography	-0.034	0.115 **
Artist's Award (0/1)	0.047	0.260 ***
Successor author (0/1)	0.027	-0.158
Number of publications	0.106	0.299 ***
Rating Amazon	0.420	0.774 ***
Number of famous heroes	0.055	0.238 ***
Control variables		
Christies (0/1)	0.067	0.580 ***
Death (0/1)	0.283 *	0.262 ***
Signature (0/1)	0.081	-0.111
Condition (0/1)	-0.199	-0.077
Constant	1.223 *	7.125 ***

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

Chapter 2:

Which price, if we all like it? Effects of liking and emotional consensus on art prices in auctions

Abstract:

This paper investigates whether consensus on liking and emotion play a role in explaining art auction prices. This study fills a gap in the economics of art literature by considering subjective perceptions of artworks in addition to objective factors in art pricing models. We conduct a survey to measure the degree of consensus on liking and emotion for 124 artworks in two distinct social groups: art collectors (*i.e.* art market insiders, N=146) and non-collectors (*i.e.* art market outsiders, N=192). We focus on the comic art market, as it is one of the rare art market which allows to easily reach collectors. We find that liking and emotional consensus are reflected in art prices but differently depending on the social group. Specifically, our results show that artworks generally achieve higher prices when they are consensually liked by insiders or eliciting positive emotions to them. However, we find that what is consensually liked by or evokes positive emotions to outsiders generally achieve lower prices at auction. This finding is remarkable as it shows that aesthetic codes shared among collectors do not spread to outsiders, but rather go in the opposite direction.

Keywords: *Art prices, auction, subjective perception, consensus, emotion, liking, art expertise*

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1. Introduction

"*It seems reasonable that efforts to appeal to a shared human aesthetics are responsible for at least part of a work's value*" suggest Graham et al. in their study (2010). The authors raise the broader issue of the behavior of art prices, asking the still not well understood question of how do art prices get at being. The question of the existence of systematic pattern in price determination of unique and non-fungible goods such as art has appealed to many economists throughout the history of economic thought, like Adam Smith, David Ricardo, William Stanley Jevons or Alfred Marshall, who agreed this kind of good is an exception to their theories (Velthius 2005). Today, even if economics of the arts and more broadly cultural economics has become a proper branch of economics (Ginsburgh and Throsby 2006), monetising seemingly invaluable features remains a fertile field under investigation.

In the literature, two main theoretical approaches to art price determination have been proposed. On the one hand, Baumol (1986), one of the first researchers in the field of cultural goods, argues that there exists no equilibrium level of prices in the art market, in contrast to manufactured goods, so that art prices are "unnatural" in the classic sense. This means that art market prices are not driven by economic forces toward an equilibrium. Instead and according to Baumol (1986, p.10), art object "*prices float more or less aimlessly*". On the other hand, although the alternative approach recognizes that a natural price does not exist for artworks, Grampp (1989) or Frey and Pommerehne (1989) support that prices are determined by supply and demand, as for any other economic good. As for empirical studies, they have essentially considered the determinants of price formation in the context of the construction of art price indexes in order to estimate rates of return to holding art. The price indexes that have been used are those relying on experts' personal judgements (such as the Sotheby's Art Index), based on the average painting (Stein 1977) or representative artwork method (Candela and Scorcu 1997), on repeated sales regression (like Goetzmann 1993, Mei and Moses 2002, 2005, Pesando and Shum 2008, Korteweg et al. 2016), on hedonic pricing model (see for example Anderson 1974, Agnello and Pierce 1996, Higgs and Worthington 2005, Renneboog and Spaenjers 2013) and on a hybrid model approach (as Locatteli-Biey and Zanola 2005, Taylor and Coleman 2011).

Among these methods developed to study the returns on artistic works, the hedonic regression analysis allows to recognize the significant explanatory variables of the price. Art is an extreme case of heterogenous good, each work being unique as created by the hand of the artist. Artworks bear many different characteristics and all of them may affect value. The

hedonic approach assumes that differences in prices are due to differences in characteristics. The purpose is to determine consumer's relative valuations of these characteristics. In practise, the price is regressed on the different dimensions, and marginal contributions – also called implicit or shadow prices – of these individual features are estimated. Previous studies have focused on objective price determinants from different categories, such as artworks' physical attributes, artist-related variables and sale characteristics, among others.

However, there are also subjective liking and emotional dimensions involved in the consumer's utility function and therefore in artwork prices. Indeed, collectors undoubtedly buy and consume art for aesthetic enjoyment – at least partly, if not totally – and build a collection of pieces of art they like. A study by Barclays (2012) reports that the most important motivation for owning art and collectibles is enjoyment (75% cited enjoyment as a key motivation of owning art[1]), whereas only a tenth of those questioned answered they bought art solely as an investment. In the literature, the emotional component has also been shown to matter for art buyers. Bourdieu (1993), Moulin (1987) and Velthuis (2005) have all taken into account the role of emotion in the art market from a sociological perspective (Herrero, 2009). From a financial point of view, many scholars who have found rather low rate of returns on paintings compared with investment in financial markets suggest to investors that "*artworks, unlike assets such as stocks, bonds, real estate, and certain investment funds, should be kept for the enjoyment of aesthetic returns as well*" (Kraeussl and Logher, 2010). An economic study by Ma et al. (2019) has recently pointed out the impact of emotions, especially the emotion of pleasure, on prices in an experimental study focused on color. Individual liking and emotion thus undoubtedly play a role in explaining the desirability and the individual valuation of art. But if many individuals share the same subjective judgement about an artwork, as pointed out by Graham et al. (2010), is the price affected?

In this paper, we investigate the effect on art prices of consensus about the perception of this art. Namely, we try to find out whether the fact that people largely share a positive or a negative perception of art has an impact on art prices. We look at the degree of consensus among individuals on two dimensions of the perception of art: the liking for art and the emotional reaction to art. Moreover, we distinguish two social groups: one group of collectors who are also market insiders and another group of lay viewers who are logically outsiders. Indeed, the level of art expertise leads to changes in individual perceptions and we may expect a different

[1] The study is based on interviews with 2000 high net worth individuals (those having more than US$1.5 million in investable assets) in 17 countries, across Europe, North America, South America, the Middle-Eats and Asia-Pacific.

impact between a consensus among art market insiders and a consensus among art market outsiders on art prices. Thus, the purpose of our paper is to examine empirically the effect of consensus on liking and emotions in two different social groups (insiders and outsiders) on art prices at auction. We answer to the following question: does a link between consensus on liking and emotions within social groups and real art prices at auction exist? In other words, could the fact that average people agree on a positive or negative perception about an art object have an impact on its price? And the fact that collectors share a same perception? There has been, to our best knowledge, no research in marketing or economics on consensus about subjective judgement in an art pricing context.

It is worth mentioning that although financial and economic studies do not make the difference between liking and emotional perceptions elicited by art exposure, the two notions are distinct. An aesthetic experience is characterized by both an emotional and a cognitive process that interact with each other (Leder et al. 2004, Leder et al. 2012, Leder at al. 2013, Leder et al. 2014). The emotions refer to the affective state, *i.e.* the perceived emotional valence, elicited by art exposure. The cognitive aspects of aesthetic experiences refer to the aesthetic evaluation and art appreciation, which are very close to the liking judgement (Leder et al. 2004, Leder et al. 2013). The liking judgement is linked to comprehension, emotion (Leder et al. 2012) and familiarity (Leder et al. 2014).

To examine the influence of liking and emotional consensus on art prices, we create a questionnaire addressed to collectors and a priori art-novice subjects respectively. Participants rate a set of artworks for their degree of liking and their emotional valence (*i.e.* positivity and negativity of emotions). As art stimuli, we select a set of comic artworks sold at one auction sale in Paris in 2017 and for which we observe the final price. We choose to focus on the comic art market because it is one of the rare art market for which there exists an online forum easily reachable that gathers many collectors (all of them being specialized in the same market), *i.e.* insiders of the market. For each artwork of our sample, the results of our questionnaire give us the emotional valence and the liking degree of participants (both collectors and lay viewers). We then construct an index of consensus to measure the degree of consensus for liking and emotion among individuals of both social groups. This approach enables us to explore the relationship between real art auction prices and the consensual aesthetic and emotional perception of insiders and outsiders using a hedonic pricing model.

Our main findings are as follows. Our results show that liking and emotional consensus affect prices differently depending on the social group from which they are issued. More precisely, we observe that artworks generally achieve higher prices when they are consensually

liked by collectors or are eliciting positive emotion to them. This result shows that collectors, who are art market insiders, have integrated common aesthetic norms about what is considered as "good art" and prices are determined depending on artwork compliance with insiders' codes and what they think is good art. Moreover, we unexpectedly find that what is consensually liked by or evokes positive emotions to novice subjects generally achieve lower prices at auction. This finding is remarkable as it shows that aesthetic codes shared among collectors do not spread to outsiders, which are also not aware of the fads that drive the art market. Even more, liking judgements and emotions from insiders go in the opposite direction with respect to outsiders' judgements, which corroborates Bourdieu's assumption (1979) stating that people engaging in arts are driven by an individualisation process through which they aspire to stand out above the crowd. Last, we find that the collectors' consensus on liking is positively influenced by artist recognition, whereas for naïve subjects, art liking is negatively impacted by the artist recognition. This shows that outsiders do not share at all art market standards.

Our contribution is twofold. First, we contribute to the literature by considering for the first time human subjective judgement of artworks and consensus in art tastes and emotions in artworks pricing models, while the empirical literature have been mainly focused on objective factors. Namely, we propose to investigate in this paper the influence of (dis)liking and emotional consensus of different groups of individuals on prices at auction, an unexplored direction of causality. Second, this research is the first to study art perceptions in an actual group of market insiders in the economic sense of the term, since studies on art evaluations consider groups of art experts –in contrast to naïve subjects – such as art students or individuals having an artistic background.

The remainder of this paper is structured as follows. Section 2 reviews the related literature on art price determinants and art perceptions. In Section 3, we present the methodology (survey design, the construction of our index of consensus, model and variables). We provide and discuss our results in Section 4. Section 5 presents a robustness test and Section 6 concludes.

2. Literature review and hypotheses

In this section, we first present the relevant literature on art prices and art perceptions (2.1.), then we discuss the hypotheses that can be drawn from the literature review (2.2.).

2.1. Literature on art prices and art perceptions

This paper aims at answering whether art prices can be explained by art perceptions, particularly consensus on art perceptions. Therefore we will explore the relationship between art prices and art perceptions in a first part (2.1.1.), then we will have a focus on the specificity of art perceptions (2.1.2.).

2.1.1. The relationship between art prices and art perceptions

The economic and financial literature has investigated the determinants of art prices. The factors impacting art prices explored so far have been mostly objective determinants from different discernible categories (2.1.1.1.), while subjective determinants related to art perceptions have received little attention, except from a few studies (2.1.1.2.). Some research in psychology of arts have examined the relationship the other way around: how monetary factors may influence art perceptions (2.1.1.3.).

2.1.1.1. The traditional determinants of prices

Typical factors in explaining art prices are physical attributes of the artworks, which are the size, medium, support, color and subject matter, and the name of the artist[2]. Other variables linked to the artist are also often added to hedonic analysis: his/her living status (Ekelund et al. 2000, Higgs and Worthington 2005, Ursprung and Wiermann 2011) and year of birth (Agnello and Pierce 1996, Campos and Barbosa 2008, Marinelli and Palomba 2011). Another category of price determinants relates to the popularity of the artwork but importantly to authenticity issues, since the risk of buying fakes is not negligible. In this category, we find the artwork inclusion in art books, catalogues or exhibitions, its previous ownership, the authentication by the artist or recognition by experts, and the presence of a signature (Czujack 1997, Figini and Onofri 2005, Campos and Barbosa 2008, Marinelli and Palomba 2011).

A set of price explanatory variables that have been generated for a while in the literature refers to sale environment characteristics. These variables are the auction house where the sale takes place, the sale location, the year and month of sale and the lot order in the sale (Pesando 1993, Agnello and Pierce 1996, Beggs and Graddy 1997, Renneboog and Van Houtte 2002,

[2] See Anderson 1974, Agnello and Pierce 1996, Czujack 1997, Higgs and Worthington 2005, Campos and Barbosa 2008, Marinelli and Palomba 2011, Renneboog and Spaenjers 2013, Ma et al. 2019, among others.

Marinelli and Palomba 2011). Moreover, art prices are influenced by macroeconomic features. Chanel (1995) suggests that short-run relations exist between art and financial markets. Goetzmann et al. (2011) argue that equity market returns have played a significant role in determining art auction art prices over the last two centuries, that art prices rise with increases in income inequality and that a robust long-run relationship between top incomes and price level in the art market exist. Lovo and Spaenjers (2018) find that prices increase in expansions. Finally, Beggs and Graddy (2009) and Graddy et al. (2015) pointed out that art prices are determined by anchoring effects.

It comes out that the price determinants considered by the literature are objective factors. Yet, some recent studies have looked at subjective factors to explain art prices.

2.1.1.2. The impact of subjective factors on art prices

Few economic studies look into the influence of subjective factors on art prices. To start with, two studies (Renneboog and Spaenjers 2013, Pénasse et al. 2014) have examined the role on art prices of the subjective expectations about the evolution of prices on the art market in the future, what the authors call art buyer "sentiment" and define as "*the unjustified optimism (or pessimism) about future resale values*" (Renneboog and Spaenjers 2013, p. 51). Renneboog and Spaenjers (2013), based on volume and rates of unsold artworks at high-profile auctions, and on media reports, find that art market sentiment forecasts art price trends. Pénasse et al. (2014), using a panel survey data on art market participants' confidence levels in the outlook for a set of artists, observe that art price appreciations are correlated to higher sentiment, *i.e.* confidence from art market participants that prices will rise in the near future for a set of artists.

Another kind of subjective factor, that time focused on the subjective perception of artworks, have been explored by Ma et al. (2019). The purpose of their study is to examine the impact of colors on the value of paintings in the field (art auction market) and in the laboratory. Based on a sample of abstract artworks, they find a significant effect of colors on art valuations in both contexts. Then, they measure in the experiment the participants' emotional – through the (dis)pleasure and (non)arousal dimensions – and find that the emotion of pleasure strongly and positively influences bids and purchase intention, while the arousal level appears to be less relevant. They argue that it is the emotion of pleasure induced by colors that is the channel whereby colors influence art valuations.

These three studies have investigated the impact of subjective factors on art prices. Yet, the relationship has also been considered the other way around, in psychology of the arts.

2.1.1.3. The impact of monetary values on art perceptions

Very few studies have investigated the influence of monetary information on art perceptions. Kirk et al. (2011) have explored the impact of monetary favors (corporate sponsorship in their study) on art perceptions and found that monetary favors presented alongside the artworks influence non-expert subjects' aesthetic preferences but not those of experts. As for Lauring et al. (2016), they have assessed in an experiment with a group of art-naïve students the impact of fictitious auction sale prices of artworks on liking ratings of these artworks. The authors observe that the art appreciation was significantly higher for paintings accompanied by a high monetary value than those characterized by low fictitious auction sale prices. Last, Graham et al. (2010) performed an initial experiment on 17 non-expert students to assess whether real auction prices are predictive of preferences and found no correlation between selling prices and preferences. In their study, individuals were unaware of the real auction price when giving their perceptions of the artworks.

It appears from this section, although there exists only a few studies, that part of the price is explained by art perceptions and at the same time that price-awareness may influence art perceptions. However, art perceptions are determined according to some contextual and social characteristics, that it is important to take into account to formulate hypotheses.

2.1.2. Specificities of art perceptions

The literature on art perceptions is essentially drawn from the psychology and sociology of the arts. Research have shown that art perceptions may differ depending on the context and the environment in which individuals are exposed to art and perceive it (2.1.2.1.), but also on social influences, either from other individuals or from one's own background (2.1.2.2.).

2.1.2.1. Contextual influences on art perceptions

Regarding contextual influences, information that helps in the interpretation of the artwork, such as title, description, the stylistic features, compositional elements, contextual information, therefore making the painting more meaningful, can have an impact upon art appreciation (Cupchik et al. 1994, Russell 2003, Belke et al. 2006, Swami 2013) as well as upon emotional reactions after the stimulus onset (Gerger and Leder 2015). Moreover, some

environmental factors modulate aesthetic judgement. According to Brieber et al. (2015), artworks were found more arousing and liked more in the museum than in the laboratory, a result that corroborates results from Kirk et al. (2009) who demonstrate that aesthetic ratings (level of appeal) are greater for a prestigious museum context than it is for a computer context. Gartus and Leder (2014) found that for participants interested in graffiti art, emotions were more positive when seeing graffiti art or modern art in a street context, compared with a museum context.

2.1.2.2. Social influences on art perceptions

Along with contextual and environmental influences individuals are subject to, social influences are major drivers of art tastes and preferences. We can distinguish two types of social influences: those from other individuals and those from one's own background, *i.e.* level of art expertise.

Since art can be considered as a symbolic good (in addition to being an economic asset, Bourdieu 1968), interacting with art appears as a social practise. Indeed, interacting with art is a mean of joining or distancing oneself from other social groups. Thus, social information may modulate personal art appraisal, as observed by Lauring et al. (2016). Through an experiment involving a group of university students, the authors find social priming effects on liking ratings. Participants change significantly their appraisals and especially raise their own liking judgements compared to the control condition (no extra information) when they believe the artworks had been positively rated by fellow students (participants' own peer group) or art experts (potentially an aspirational group) or when they believe the artworks had been negatively rated by low-income/education social group (less socially desirable group). This social priming effect is positively correlated with group identification, so that when participants identify highly with a priming social group and were told this group had rated the artworks positively, the impact on liking ratings is stronger. These findings suggest that individual and personal art appraisal may be adapted according to what we believe to be the judgements of those with whom we want to stand out from (less desirable social group), of a group with which we socially identify and want to be part of, and of a group we aspire to belong to. Individuals tend to modulate their tastes closer to the preferences of the groups they like (peers or aspirational social groups) and further away from the preferences of the groups they don't like. Bourdieu's theory of social distinction (1968) finds empirical support, as art preferences may be the basis of social differentiation and establish distinct social groups. Another recent study

by Hesslinger et al. (2017) who have tested the impact of social conformity pressure on aesthetic judgements also finds a significant effect. The desire to conform to one's reference group has also been observed for other goods than art, such as music (Berns et al. 2010) or luxury products (Bearden and Etzel 1982, Childers and Rao 1992).

Besides and among social influences that can affect aesthetic evaluation, the level of art expertise of an individual is an important factor. Artistic training and knowledge lead to changes in individual perception and aesthetic appraisal of a stimulus and therefore in taste and aesthetic preference. Individual differences in the salience of the dimensions involved in perceiving artworks depending on individual artistic experience have been reported: art-novice subjects attach more importance to the degree of realism, *i.e.* have a preference for more traditional works, but less importance to the clarity of detail compared to art-trained subjects (O'Hare 1976).

Moreover, Cupchik and Gebotys (1988) found that trained viewers underestimate the duration of exposure to aesthetic stimuli regardless of painting complexity, while naïve viewers overestimate exposure duration, especially for highly complex stimuli. This finding reflects differences in the amount of perceptual/cognitive effort needed by novice and trained subjects to appreciate a painting: naïve subjects have to struggle to perform analyses while trained viewers perform automatic processing thanks to a set of skills to assess paintings developed over time. This study also reveals divergence in judgements of aesthetic pleasure between untrained and trained subjects and a higher aesthetic flexibility on the part of naïve viewers, who may adjust their preferences after longer exposure.

The level of formal art training affects the individual scanning patterns and modifies the way individuals observe paintings by changing their areas of attention. Thus, Nodine et al. (1993) who based their study on eye-movement analysis reveal that novice viewers fixed their eyes on the pictorial elements of the composition therefore spending more time looking at central and foreground figures, while art-trained viewers give more attention to the overall compositional design, *i.e.* to the relationships among shapes, colors and space, hence looking also at background features. This result suggests that untrained subjects focus more on individual pictorial elements and their representational accuracy, but this representational issue is supplanted with art training by concerns about global recognition of pictorial structures that express narrative themes. Their findings uphold observations by Winston and Cupchik (1992, p. 12) that "*naïve viewers generalize from everyday perception and search for the familiar and the moderately stimulating*" while experienced viewers' "*approach to art is not predicated on*

the identification of objects, but rather on principles which are distinctive to the aesthetic domain, such as composition, harmony, contrast, texture, and emotional expressivity". Based on questionnaires answered by trained and untrained art viewers, they demonstrate that art education shapes the expectations and motives of individuals when they experience aesthetic episodes. More recent studies have kept finding differences between experienced and inexperienced viewers in the way they look at paintings, based on the analysis of eye movements (Vogt 1999, Vogt and Magnussen 2007, Ylitalo et al. 2016).

What is more, emotional reactions to art which play an important role in aesthetic experiences are also affected by expertise. Leder et al. (2012) found that expertise increases liking, emotions and understanding ratings, but also that expertise comes with a more flexible and idiosyncratic interplay of cognitive and emotional variables that determine art appreciation compared to non-experts. However, Leder et al. 2014 who based their study upon a participants' larger range of expertise found that art experts show attenuated emotional responses compared to laypeople (indicated by facial electromyography) and their emotional ratings of artworks show likewise a trend towards attenuation compared to nonexperts, providing less extreme valence ratings. This result could be explained by distinct emotional processing with expertise which weakens the immediate impact of emotions and allows the expert to adopt a detached mode in order to proceed to aesthetic judgements. Lay viewers especially base their aesthetic appreciation on personal feelings, while art-experienced persons rather focus on style and form (Winston and Cupchik 1992, Augustin and Leder 2006). Still, when being asked to evaluate art quality, art experts rely more on their gut feelings or intuition than lay viewers who rather draw upon an analysis of their level of understanding of the artwork's meaning.

It must still be noted that clear differences between experienced and inexperienced art viewers have not always been found empirically. For instance, Locher and Nagy (1996) and Locher et al. (1996, 1999, 2003) demonstrate that the ability to identify a visually right composition, *i.e.* a painting that has a very efficient structural organization of its pictorial features, does not require a design expertise[3]. Another example is given by Neperud (1986) who found moderate support for the hypothesis that art and non-art students differ in their response to aesthetic episode: art students rated their pleasingness higher than non-art students as for abstract art stimuli, but no significant differences has been found between the two groups as for

[3] Locher et al. (1999) nonetheless observe a higher ability for design professionals than for untrained subjects.

figurative, collage or pattern art styles. A last illustration is the study by Lindauer (1990) who showed that mass-produced art (*i.e.* manufactured and "cheap" art) was generally liked, regardless of education and background in the arts, because this type of art – typically cliché-like images – brings peacefulness, are reassuring and requires little effort to understand.

2.2. Hypotheses

The literature has shown that art prices and subjective factors are linked. On the one hand, studies have found that art prices are influenced by emotions and sentiment of bidders. On the other hand, monetary information can have an impact on subjective perceptions. In line with these few studies, subjective factors need to be taken into account in art pricing models since they may be relevant to explain prices. This leads us to hypothesize that consensus on subjective perceptions – in our analysis, consensus on liking and emotions – may play a role in explaining auction prices:

H1: *Consensus on art perception is reflected in auction prices.*

Also, studies in psychology and sociology of the arts have shown that subjective perceptions differ depending on contextual factors, but also on social factors, such as the influence of other people and the influence of one's own background. Firstly, individuals tend to adapt their art preferences towards the preferences of the group they socially identify with or want to be part of. Secondly, the level of art expertise seems to involve changes in art perceptions and preferences. Thus, the study of the consensus on art perceptions and its effect on prices must be differentiated depending on the social group of the participants. Indeed, it is very likely that art collectors and novices do not share the same preferences, but that art collectors agree among themselves on their art perceptions and that novices also agree among themselves on their art assessment. Consequently, we distinguish for our study of the art perceptions between art collectors (who are market insiders) and students (who are art novices). This leads us to measure the consensus on art perceptions among insiders and among outsiders separately and analyse their respective effect on auction prices. We expect that auction prices may be explained by consensus on art perceptions of insiders, but not of outsiders, so that the explanation of the price by consensus on art perceptions is only valid for one kind of population (insiders). The hypotheses are thus the following:

H2a: *Auction prices reflect consensus on art perceptions of insiders only.*

H2b*: Auction prices do not reflect consensus on art perceptions of outsiders.*

3. Methodology

We begin this section dedicated to the presentation of the methodology of this paper by describing the survey design, especially the participants, the materials and the procedure (3.1.). Then, we detail the construction of our indexes of consensus (3.2.). Last, we introduce our sample, variables, the descriptive statistics and we finish by explaining our model (3.3.).

3.1. Survey design

As the present research aims at testing the influence of consensus on subjective perceptions – liking and emotion – on art prices, we measure subjective perceptions of two distinct social groups by means of a survey. Participants, materials and procedure are described hereafter.

Participants

We conducted the survey with two distinguished groups of individuals: a group of art novices and a group of comic art experts. The first group of participants – the art-naïve group – consists of students from the University of Strasbourg. A total of 176 students (85 female) studying for a degree at the same school of political science took part in the survey. Five of them were excluded from our sample because they failed the test of consistency of their answers (explained in the survey procedure hereafter). Our final sample of art novices thus comprises 171 students. The same education track limits influences like the field of study or the experience. Mean age is 21 years (SD = 2.05). These students do not have a prior expertise or training in comic art *a priori* (this point will be assessed later in the study). The survey was sent by email to all students and they were free to answer to the survey. They did not receive any monetary compensation or grade bonus, but were proposed to be mentioned in the study acknowledgments if they made an evaluation of a minimum of 40 artworks.

The second group of participants – the comic art collectors – are members of the comics specialized website BDGest©[4]. BDGest, created in 2001, is the website where the largest community of francophone *bande dessinée* connoisseurs meet. It includes tools for the management of comics collections and sales, an online forum about comics, contests, previews, news, specialized articles, etc. This website gathers more than 100 000 subscribers. We posted a message with the link to our survey on a forum of this website which is dedicated to comic

[4] https://www.bdgest.com

art (*i.e.* original comic) and which gathers only individuals genuinely interested in comic art. In this forum, individuals indeed discuss artworks they own in their collections or artworks that will be soon on sale. Thus, the population of this forum we contacted is composed of market insiders. Members of this forum were free to participate to the survey. A total of 171 experts (4 female) took part in the survey. Mean age is 49 years (SD = 9.70). Four of them were excluded from our sample because they failed the test of consistency of their answers (explained in the survey procedure hereafter). Our final sample of art collectors thus comprises 167 individuals. They did not receive any monetary compensation, but were proposed to be mentioned in the study acknowledgments if they assess a minimum of 40 artworks.

Participants of both social groups were informed that participation and data collection were anonymous, but they were given the possibility to leave their name if they wanted to be mentioned in the study acknowledgments provided they fulfil the condition.

We perform a further control of our two categories – insiders and outsiders– based on participants' self-reported collecting behavior. Participants had to fill an art-expertise questionnaire before starting the survey, one of the question being "Do you collect original comic?". We found that three student participants do collect comic art; they were therefore reassigned to the insiders category. Likewise, twenty four of our BDGest participants do not identify as collectors, so that they were reassigned to the group of lay viewers. Finally, after these changes, we count 146 collectors (*i.e.* insiders) and 192 non-collectors (*i.e.* outsiders).

Materials

The stimuli consisted of 124 pictures of comic artworks sold by the auction house Artcurial on the 8th of April, 2017 in Paris. We note that comic artworks are figurative art stimuli.

We focus on the comic art market since it is one of the rare art market for which there is an online forum (on BDGest) easily accessible that gathers many French and Belgian collectors. Indeed, on other art markets such as old masters paintings or impressionist and modern art for example, there is no such unique forum on which a significant number of collectors gather[5]. Consequently, the only way to reach insiders on other art markets would be to ask auction houses and galleries for their lists of individuals who are interested in one kind

[5] There exists some forums for collectors, but more for collectible goods (like stamps, coin or toys) than for art. For instance, there is the "Forum des collectionneurs" (http://collections.forumgratuit.org/forum) with 1200 members. Another example of forum is the "Art Collectors Club" on Facebook with 70 000 members, a forum which is very general and not focused on a specific art market.

of art or have bought/sell on this art market. This process raises problems of authorization, of confidentiality and would certainly not result in such an important number of answers as it is the case for our survey through BDGest forum. On the contrary, participants on BDGest forum register and intervene freely which enables us to be sure to reach a population of comic art market players.

Moreover, we choose to focus on a sale of 2017, while conducting our survey in 2020. The purpose of this paper is to understand to what extent subjective perceptions of individuals and especially consensus on subjective perceptions translate in art prices at auction; consequently a set of artworks presented at auction had to be selected. Auction houses publish the catalogue around one month before the auction sale (depending on the auction house). However, if we would have asked collectors about their subjective perceptions of artworks that are about to be presented for sale (*i.e.* before the sale), they would have known about the pre-sale estimates given by experts of auction houses and would have been influenced by the discussions with other collectors such as those held within BDGest dedicated forums. Therefore, we choose to select an auction sale that occurred three years before our survey, in order that collectors have forgotten about the auction sale. We do not select a longer period either, so that fads would not change over the period, since fads are moving slowly (Pénasse et al. 2014).

Last, we discarded artworks by Hergé auctioned in this sale in order to minimize socio-cultural and familiarity influences for lay viewers in our results. Indeed, Hergé holds a special place in the comic art world and market. Thanks to the comic series of *The Adventures of Tintin* that turned into a global success, Hergé is by far the best-known comic artist and his creative work has spread through all social strata, becoming part of the popular culture especially in Europe. Moreover, on the European comic art market, Hergé's artworks are the ones that reach record prices by far.

Procedure

The questionnaire was created on LimeSurvey© software and was sent by email to students and posted on the forum of BDGest website for comic art experts. We proposed the questionnaire in French and in English for comic art experts. Our questionnaire comprised three parts: i) an introductory instruction, ii) a questionnaire for comic art/world interest and art expertise and iii) the questionnaire containing the stimuli and questions related to participants' subjective perception of them.

The introductory instruction told the participants that they would see a series of original comic artworks sold at auction in the past and that they would be asked to evaluate each artwork for their degree of liking and emotion. Examples of negative emotions (anger, disgust, contempt) and of positive emotion (pleasure, arousal, enjoyment) were given. Participants were not informed about the goal of the study and how their answers will be exploited, only that this survey is part of a research project on subjective perceptions and does not serve any commercial purpose.

The second part of the survey aims at obtaining basic personal information about participants and measuring their art/comic art expertise, as the literature pointed out the role of expertise in aesthetic judgements. After two questions related to personal information (sex and year of birth), we measured expertise by a self-developed short questionnaire (Appendix 1.A.) containing five items on comic background (their knowledge of and interest in the comic world, their comic collector behavior) and art background (art-related education, art practise). We use 5-point Likert-type scale (1 = not at all; 5 = absolutely) for the questions related to the knowledge and interest in the comic world and to the art background. For the comic collector behavior, we use a multiple choice question.

The third phase concerns the questionnaire as such, with pictures of artworks to assess displayed (Appendix 1.B.). Images of artworks were directly drawn from the auction house catalogue and re-sized so that the width size equalled 400 (in units used by Limesurvey©), while keeping the original proportions. Participants judged each of the depicted aesthetic stimuli without receiving any information or description about it, by the means of two questions. For each stimulus, participants were asked to evaluate on the one hand for their degree of liking, using a 5-point Likert-type scale (1 = dislike very much; 5 = like very much) and on the other hand the intensity/polarity of their emotion triggered by the sight of each artwork, using a 5-point Likert-type scale (-2 = strong negative emotion; 0 = no emotion; 2 = strong positive emotion).[6] We selected the "liking" measure as it is a general measure of personal preference and aesthetic judgements (Reber et al. 2004, Leder et al. 2005, Leder et al. 2013). Moreover, both aesthetic judgement and emotions appear to be two distinct but relevant components of aesthetic experiences and evaluations (Leder et al. 2004, Leder at al. 2013), so that we consider these two dimensions measured by liking and emotional valence scales in our study. It is undeniable that liking is determined by emotion, so that the two are essentially related, but liking for art is also affected by comprehension of artworks and familiarity (Leder et al. 2004,

[6] We chose to use two different types of Likert scales to help the participants distinguish between the question on their liking and the one on their emotion.

Leder et al. 2012, Leder et al. 2014). Stimuli were presented in a randomized order and after each set of 10 stimuli, participants had the choice to exit or continue the questionnaire. However, in order to continue the questionnaire, the two rating scales (*i.e.* liking and emotion) had to be completed for all artworks previously seen.

When leaving the survey, participants had a last question in order to test for the consistency of their answers. They were shown four groups of images and were asked to select one group in which they recognize an artwork they rated. In these groups of images proposed, there was a mix of the pictures of artworks selected for this study and pictures of artworks that were sold in another comic auction sale (Christie's). Participants who did not answer correctly were excluded from the sample (in total, 9 individuals). There was no time limit for the ratings. For both groups, the survey was opened for 15 days over a close time period (spring 2020). Each social group did not know that another group was also asked the same questions.

3.2. Measuring consensus

From the data collected with the questionnaire, we construct a new index, which we call *VALCONS*, that combines valence (*i.e.* the positivity or negativity) and intensity of the consensus of subjective liking and emotional judgements made by individuals. We aimed to obtain an index that takes higher values when respondents agree on high ratings attributed to an artwork (consensus on positive perception) and lower values when respondents agree on low ratings given to an artwork (consensus on negative perception). This index of consensus can be applied for both the subjective perception of liking and emotion. To take into account the valence in our index, the first component on which this index should be based is the mean of all grades attributed by the participants. As mentioned above, grades range from 1 to 5 for liking judgement and from -2 to 2 for emotion judgement. With the sole objective of proposing one identical index for both types of subjective judgement, we normalize the emotional judgement from a -2-to-2 scale to a 1-to-5 scale, as for the liking judgement, by adding systematically 3 points to the emotional grade attributed by participants. From there, a mean rating close to 5 indicates an positive average judgement, while a mean grade close to 1 states a negative average judgement. In order to address the intensity of the consensus for our index, we now turn to the second component of this index: the standard deviation measure. A small standard deviation attests a high consensus among respondents, while a high standard deviation indicates presence of a dissensus among participants about artwork judgement. Thus, for any artwork (*i*), the formula for our index of consensus is the following:

$$VALCONS_i = \frac{m_i - 3}{\sigma_i (m_i - 1)(5 - m_i)} \qquad (1)$$

where $VALCONS_i$ is our consensus index for an artwork (i), m_i is the mean of the grades given by participants and σ_i is the standard deviation of the grades attributed by participants.

When the average rating given by participants is included between 3 and 5, meaning a positive perception of the artwork, the index is positive. Also, the smaller the standard deviation is, meaning that participants reach a consensus on their subjective perception, the higher is the index. Conversely, when the average rating given by respondents lies between 1 and 3, which demonstrates a negative judgement of the artwork, the index turns negative. Moreover, the smaller the standard deviation is (*i.e.* people surveyed agree on their subjective judgement), the lower is the index. Further details on the behavior of our *VALCONS* index are provided in Appendix 2.

The merit of the *VALCONS* index is that it measures the valence combined with the intensity of the consensus of the ratings given by participants. The higher is this index, the more participants agree on a positive rating, whereas the smaller is this index, the more participants agree on a negative rating. We distinguish in our study one *Liking-VALCONS* index, based on participants' rating of their liking, and one *Emotion-VALCONS* index, based on participants' rating of their emotion. An index close to 0 is consistent with an artwork that is moderately liked/disliked (for Liking-VALCONS) or that is triggering low emotional response (for *Emotion-VALCONS*), or reflects a dissensus on perceptions among participants.

3.3. Empirical implementation

In this section, we first discuss the sample selection (3.3.1.). Then, we present the variables (3.3.2.) and the descriptive statistics (3.3.3.). We finish by explaining the model (3.3.4.).

3.3.1. The sample

Our sample comprises the 124 auctioned artworks used as stimuli for the survey. These are artworks sold in 2017 by Artcurial during one single auction sale. We choose to focus on one auction sale only in order to prevent any sale effect to interfere in our estimates. We select

the European comic art market (an American market for comics also exists) in order to be coherent with the scope of the BDGest community, which is mostly focused on European comics. The Artcurial sale includes different types of comic art: boards, coverpages, illustrations, drafts and colorings (the colored distinct support when colors are dissociated from the drawing strokes). Drafts and colorings being unachieved artworks, we exclude them from our sample. Finally, since we are interested in price determinants, we also remove all bought-in lots (*i.e.* lots without prices because they have not been sold during the auction, as bids did not reach the seller's reserve price).

Regarding the number of subjective ratings per artwork, there is at least 89 expert ratings on one artwork and maximum 102, with a median of 97 evaluations by experts per lot. Non-experts participants rated on average less artworks than did the experts (*i.e.* were ending the survey before), so that the median number of lay viewer judgements per lot is 84 (minimum 73, maximum 90). In the end, each lot is appraised by 179 participants in average (with a minimum of 169 and a maximum of 189 judgements).

3.3.2. The variables

The dependent variable is the logarithm of real EUR final price, buyer's premium included, since it is the price buyers are willing to pay to acquire the object.

The category of variables related to the subjective perceptions are the explanatory variables of interest and have little been explored in the literature so far, thus being particular to our sample. These variables have been elaborated on the basis of a survey and consist of two indexes of consensus on aesthetic judgements (explained above in section 2.2.): *Liking-VALCONS* and *Emotion-VALCONS.* These indexes of consensus are considered across each social group – collectors and non-collectors– so that, for each artwork, we have four indexes of consensus in total on subjective perceptions: *Liking-VALCONS - insiders, Liking-VALCONS - outsiders, Emotion-VALCONS - insiders* and *Emotion-VALCONS - outsiders.* The two next groups of variables related to the artist and the artwork can be considered as control variables.

We consider a first set of variables that refers strictly to the artist who created the artwork, as previous research has shown the importance of the artist's effect in the determination of auction prices. We include i) the length of the artist's biography[7] (number of

[7] We consider the website Bédéthèquet© (https://www.bedetheque.com) – a reference for European comic culture gathering of information (see below) – to collect the comic artists' biographies.

words) as a proxy of their reputation, ii) whether they have received an award or not as a proxy of the artist's recognition (dummy) and iii) their living status (dummy).

With respect to artworks' physical characteristics, recognized as factors affecting prices, we consider the type of comic artwork (dummies introduced for boards, coverpages or illustrations), the medium (four non-excludable dummies accounting for ink, paint, pencil or pasting/mixed medium), the size (in square meters), the condition (dummy that equals one if the artwork is damaged), the presence of a signature (dummy that equals one if the artwork is signed) and the subject matter(s) (non-excludable dummies for a wide set of topics, which can be seen in Table 1 showing descriptive statistics). We also include three attributes related to the artwork as well but which represent specific dimensions of comic art. The first variable is the number of publications of the artwork. Indeed, comic artworks are of "hybrid" nature since they are unique pieces of art created by an artist and at the same time commercial goods gathered and published on a large scale for the purpose of selling comic books. The number of publications of the comic book from which the artwork stems reflects the commercial success of the comic book and consequently the artwork. It is reasonable to think that such dimension can have an impact on prices. The second variable is a black and white dummy, which takes the value of one for black and white artworks and zero for colored artworks. Indeed, both kinds of artworks exist on the comic art market and color is a determinant of art prices (Ma et al. 2019). The third and last specific feature of comic art is linked to the presence of the hero. The hero is a key dimension of comic art and a comic artist becomes famous after his hero does so. Therefore, we assume comic art buyers prefer artworks with the presence of the hero than artwork without, so that prices can arguably be impacted. We thus count the number of times the hero appears on each artwork. However, heroes are not similarly famous. For this reason, we weight the number of heroes depicted in an artwork by the Amazon© ranking of the comic book from which the artwork originates. This ranking reflects the popularity of the comic book, and in turn of the hero. This weighting brings about a consistent variable accounting for the number of famous heroes. Detailed definitions of all variables are given in Appendix 3.

3.3.3. Descriptive statistics

The explained variable is the auction price of each artwork. Descriptive statistics of the dependent variable are reported in Table 1. On the 124 auctioned comic artworks sold by Artcurial selected for this study, the average final purchase price (all fees included) is a little higher than 7 000 €, while 50% of them were sold to buyers under 3 120 €. Final purchase

prices range from a low price of 130 € to a high price of 78 000 €. The mean price per square centimetre is 5.43 € and the median is 1.96 €. Prices for one square centimetre range from 0.17 € to 86.76 €. The average mean-estimate (midpoint between high and low pre-sale estimates) of our sample is 5 181€. This shows that the Artcurial sale is representative of the comic art market, neither being a prestigious sale such as those of Christie's (with an average pre-sale mean estimate around 14 000 € in 2017) nor being part of the mid-range to low-end market, as sales by Coutau-Bégarie or Cornette de Saint Cyr for example (with an average pre-sale mean estimate around 1000 € in 2017).

Table 1 Descriptive statistics of the dependent variable : the price

Variables	Mean	Median	Std Dev	Min	Max
Hammer price	5 436	2 400	9 040	100	60 000
Price buyer's premium incl.	7 075	3 120	11 750	130	78 000
Average pre-sale estimate	5 182	2 250	8910	150	65 000
Price per cm2	5.43	1.96	10.86	0.17	86.76

One category of independent variables consists of our variables of interest, *i.e.* our indexes of consensus on subjective perceptions. Table 2 reports descriptive statistics related to these variables.

For each lot, many insiders and outsiders have given their own rating on liking and emotion. Consequently, we have for each lot one grade on liking and on emotion for insiders (which is the mean of all ratings given by the insiders on that particular lot) and one grade on liking and on emotion for outsiders (which is the mean of all ratings given by the outsiders on that lot). Likewise, we have for each lot one standard deviation on liking and on emotion for insiders (which is the standard deviation of all grades given by insiders on that lot) and one standard deviation on liking and emotion for outsiders (which is the standard deviation of all grades given by outsiders on that particular lot). Our index of consensus *VALCONS* (Equation 1) for each artwork has been constructed using these means and standard deviations. Therefore, we report in our descriptive statistics the mean rating and the standard deviation of the ratings of insiders and outsiders on liking and on emotion.

Regarding the liking rating, the average artwork (on the 124 artworks of our sample) receives the grade of 3.24 on a 1-to-5 scale by insiders, while the average artwork receives the grade of 3.31 by outsiders. These grades are close and above the 3-rating that figures a moderate

liking, indicating that collectors and non-collectors rather like than dislike the artworks presented in the sample. We observe that insiders give more extreme liking grades (the minimum mean rating given to a lot by experts is 1.97 and the maximum 4.34) compared to naïve viewers (mean ratings that range from 2.44 to 4.29). This suggests that naïve viewers discriminate less between artworks in their liking choice. Besides, collectors agree slightly more than naïve comic art viewers on their liking judgements on a piece of art, as the standard deviation of liking ratings attributed by experts for the average artwork is lower than the one attributed by lay viewers (1.03 and 1.09 respectively). In accordance, the maximum standard deviation for liking ratings has been achieved by outsiders, not insiders (1.30 and 1.52 for insiders and outsiders respectively).

Regarding the emotional rating, the average artwork receives the grade of 3.26 on a 1-to-5 scale by collectors and 3.24 by non-collectors. These positive and very similar grades show that artworks of our sample elicit rather positive emotion than negative emotion to both social groups. Otherwise, as for liking ratings, insiders give more extreme emotional grades then do outsiders (the emotional grades per lot range between 2.33 and 4.30 for insiders and between 2.40 and 4.10 for outsiders), but they agree slightly more than outsiders on their emotional grades for an artwork (standard deviation of 0.93 and 0.97 for insiders and outsiders respectively).

We then turn to the analysis of the consensus on liking and on emotion (*Liking-VALCONS* and *Emotion-VALCONS*). We find that both indexes have similar mean values between insiders and outsiders (0.072 for collectors and 0.088 for non-collectors on the *Liking-VALCONS*; 0.082 for collectors and 0.076 for non-collectors on the *Emotion-VALCONS*). These mean values are positive but close to 0 which means that when considering all lots of our sample, we observe in average a dissensus or a feeble positive consensus. This might be explained by the fact that our consensus indexes can be negative or positive, so that the values of the consensus indexes for the different lots compensate with each other. Standard deviations of our *VALCONS* indexes which range between 0.109 and 0.138 indicate that our consensus indexes take a variety of different values. As these aggregated statistics on all lots do not reveal important differences between outsiders' and insiders' perceptions and consensus, an approach per lot with econometrics seems to be particularly relevant. Lastly, we note that both for liking and emotion, consensus indexes take more extreme values in the group of collectors than in the group of non-collectors. This shows that collectors may be able to like or dislike pieces of art more strongly, to report deeper emotional feelings (positive or negative) and to achieve higher consensus than do non-collectors.

Table 2 Descriptive statistics of subjective perceptions

Variables	Mean	Median	Std Dev	Min	Max
Liking rating					
Mean rating per lot for liking - insiders	3.24	3.22	0.42	1.97	4.34
Standard deviation per lot for liking - insiders	1.03	1.02	0.11	0.81	1.29
Mean rating per lot for liking - outsiders	3.31	3.31	0.37	2.44	4.29
Standard deviation per lot for liking - outsiders	1.09	1.08	0.14	0.79	1.52
Emotion rating					
Mean rating per lot for emotion - insiders	3.26	3.25	0.32	2.33	4.30
Standard deviation per lot for emotion - insiders	0.93	0.91	0.11	0.64	1.23
Mean rating per lot for emotion - outsiders	3.24	3.22	0.36	2.40	4.10
Standard deviation per lot for emotion - outsiders	0.97	0.94	0.15	0.47	1.34
Indices of consensus - liking and emotion					
Liking-VALCONS - insiders	0.072	0.058	0.138	-0.369	0.696
Liking-VALCONS - outsiders	0.088	0.077	0.114	-0.148	0.653
Emotion-VALCONS - insiders	0.082	0.068	0.109	-0.231	0.659
Emotion-VALCONS - outsiders	0.076	0.062	0.112	-0.152	0.454

Our second and last category of independent variables accounts for the artist's and the artwork's characteristics. Table 3 reports descriptive statistics of these variables.

Regarding the artist, we account for the artist's reputation, recognition and his/her living status. As a proxy of the artist's reputation, we use the artist's biography which contains on average almost 500 words. The length of the biography ranges from 0 to almost 1600 words in our sample. Moreover, more than one third of our sampled lots have been produced by awarded artists. This means that our sample is balanced in terms of artworks created by recognized artists and less known artists (having no biography on the specialized comic website Bédéthèque). Lastly, 41% of the lots have been produced by artists deceased at the time of the sale.

We now turn to the attributes of the artworks. The pre-sale catalogue provides information on different characteristics: the type of artwork, the medium used, the size, the condition and the presence of a signature. With respect to the type of artwork, our sample gathers 64% of boards, 12% of coverpages and 24% of illustrations. Boards are the main type of comic art, as a set of boards constitutes the comic book. For each comic book there is only one coverpage, which explains that coverpages represent a moderate percentage of the sale. Illustrations are drawings which are independent from the boards. As to the medium used, ink is the most typical medium comic artworks are made of (90% of our sample), paint is used for 56% of our sample, pencil for 25% and pasting and mixed medium for 18%. These percentages indicate that comic art often combine several techniques and they can be understood in the light

of the creation process of boards. Indeed, pencil is generally used by artists to first draft their boards. Boards are then inked and they may be colorized ultimately, either directly or on a separate material. Also in the light of this process of creation, it is coherent to see that black and white artworks represent the majority (64%) of the artworks of our sample. We finally find out that the average size of our sampled artworks is 0.18 square meters and that most of them are signed (66%) and in good condition (90%). The presence of a signature is considered as a proof of authenticity.

Moreover, catalogues provide images of the lots for sale, which allow to include the topic(s) and the number of heroes displayed as independent variables. The main subject matters depicted (in more than 20% of our lots) are genre scenes, action, adventure/suspense, archetypes, humor, and interactions. Topics are non-excludable as comic art can cover more than one subject matter. The hero appears in average twice and in the majority of the artworks once or more. Finally, we take into account the commercial success of the comic book from which the artwork comes. Our sampled artworks have been published in average more than three times and 50% of them have been published twice or more. The number of publications for our sample ranges between 0 (for illustrations) and 20. Our sample is thus composed of artworks which have met with varying degrees of retail success.

Table 3 Descriptive statistics of artist's and artwork's characteristics (control variables)

Variables		Mean	Median	Std Dev	Min	Max
Length of the biography		496	359	389	0	1 594
Artist's Award (0/1)		0.36	0	0.48	0	1
Death (0/1)		0.41	0	0.49	0	1
Signature (0/1)		0.66	1	0.48	0	1
Size (m2)		0.18	0.14	0.14	0.01	0.89
Condition (0/1)		0.10	0	0.30	0	1
Type (0/1) :	Board	0.64	1	0.48	0	1
	Coverpage	0.12	0	0.33	0	1
	Illustration	0.24	0	0.43	0	1
Medium (0/1):	Ink	0.90	1	0.30	0	1
	Paint	0.56	1	0.50	0	1
	Pencil	0.25	0	0.43	0	1
	Pasting/mixedmedium	0.18	0	0.38	0	1
Color (0/1): Black and white		0.64	1	0.48	0	1
Subject matter (0/1):	Action	0.27	0	0.45	0	1
	Adventure/suspense	0.21	0	0.41	0	1
	Archetypes	0.24	0	0.43	0	1
	Arts	0.08	0	0.27	0	1
	Erotism	0.10	0	0.30	0	1
	Fantasy/Magic	0.12	0	0.33	0	1
	Genre	0.35	0	0.48	0	1
	Historical context	0.06	0	0.25	0	1
	Humor	0.23	0	0.42	0	1
	Interaction	0.23	0	0.43	0	1
	Landscape	0.17	0	0.38	0	1
	Portrait	0.08	0	0.27	0	1
	Science-fiction/high-tech	0.17	0	0.38	0	1
	War/Violence	0.11	0	0.32	0	1
Number of heroes		2.15	1	3.22	0	21
Ranking Amazon		418 965	197 900	525 274	6 067	2 432 967
Number of publications		3.16	2.00	3.88	0	20

3.3.4. The model

To test for the influence of consensus about subjective judgements of art on auction prices this art actually reaches, we estimate hedonic pricing models. Our dependent variable is the (log) final auction price of each artwork. Our dataset comprises the hammer price and purchase price. The latter differs from the former because it includes the buyer's premium, which corresponds to transaction fees charged to the buyer by the auction house in addition to the hammer price. We consider the price buyer's premium included since it is the real price buyers are willing to pay for the good. We use our different indexes of consensus on subjective perceptions as explanatory variables while controlling for the intrinsic heterogeneous character of artworks with a set of hedonic characteristics. To avoid any risk of multicollinearity between

liking and emotional indexes, we estimate two models. Model 1 includes liking consensus indexes (Equation 2a) and Model 2 includes emotion consensus indexes (Equation 2b). This leads to the following specifications:

$$\ln p_i = \alpha + Liking\text{-}VALCONS\text{-}insiders_i\beta_1 + Liking\text{-}VALCONS\text{-}outsiders_i\beta_2 + \sum_j Artist_{j,i}\gamma_j + \sum_k Artwork_{k,i}\delta_k + \varepsilon_{1,i} \quad (2a)$$

$$\ln p_i = a + Emotion\text{-}VALCONS\text{-}insiders_i b_1 + Emotion\text{-}VALCONS\text{-}outsiders_i b_2 + \sum_j Artist_{j,i}c_j + \sum_k Artwork_{k,i}d_k + \varepsilon_{2,i} \quad (2b)$$

where $\ln p_i$ is the log of the price of artwork *i (i* = 1, …, *N)*, $Liking\text{-}VALCONS\text{-}insiders_i$ and $Liking\text{-}VALCONS\text{-}outsiders_i$ are the liking indexes of consensus of insiders and outsiders respectively, $Emotion\text{-}VALCONS\text{-}insiders_i$ and $Emotion\text{-}VALCONS\text{-}outsiders_i$ are the emotion indexes of consensus of insiders and outsiders respectively, $Artist_{j,i}$ is the measurable artist-related attribute *j (j* = 1, …, *J)* of artwork *i*, $Artwork_{k,i}$ is artwork-specific feature *k* (*k*=1,…, *K*), $\beta, \gamma, \delta, b, c,$ and d are unknown coefficients that represent the implicit prices of the linked characteristics, $\varepsilon_{1,i}$ and $\varepsilon_{2,i}$ are the error terms.[8]

4. Results

This section is dedicated to the presentation and discussion of the results. We first analyse the impact of consensus about subjective perception of insiders and outsiders on art prices (4.1.) before having a closer look at what determines consensus on subjective perceptions of insiders and outsiders respectively (4.2.).

4.1. Impact of consensus about subjective perceptions on art prices

We aim at testing whether liking and emotional consensus influence artwork prices. To do so and as given by equations (2a) and (2b), we regress auction prices on liking and emotion indexes of consensus for both social groups, comic art collectors and non-collectors. We add

[8] We apply Durbin-Wu-Hausman Tests (DWH) to determine if our models suffer from endogeneity issues. We use two instruments which are proxies of the degree of realism and of complexity of the drawings, obtained from the ratings of a panel of 21 experts. These tests reject any statistical presence of endogeneity in the *VALCONS* variable.

variables related to artist and artwork as controls that are kept identically for both specifications. Table 4 shows the results from our hedonic regressions.

Table 4 Dependent variable: (log) price, buyer's commission incl.

Variables		**Model 1**	**Model 2**
Liking-VALCONS - insiders		5.102 ***	
Liking-VALCONS - outsiders		-2.496 **	
Emotion-VALCONS - insiders			6.442 ***
Emotion-VALCONS - outsiders			-2.985 ***
Control variables			
Length of the biography		-0.011	-0.023
Artist's Award (0/1)		0.660 ***	0.681 ***
Number of publications		0.319 **	0.321 **
Death (0/1)		0.160	0.165
Signature (0/1)		0.188	0.157
Size (m2)		0.261 *	0.249 *
Condition (0/1)		0.157	0.129
Type (0/1) :	Coverpage	0.856 ***	0.862 ***
	Illustration	0.304	0.208
Medium (0/1):	Paint	-0.190	-0.198
	Pencil	0.458 **	0.397 **
	Pasting/mixedmedium	-0.259	-0.177
Color (0/1): Black and white		-0.262	-0.284
Subject matter (0/1): Action		-0.120	-0.155
	Adventure/suspense	-0.184	-0.192
	Archetypes	-0.154	-0.141
	Arts	0.927 ***	0.940 ***
	Erotism	-0.154	-0.139
	Fantasy/Magic	0.802 ***	0.833 ***
	Genre	0.228	0.250
	Historical context	0.087	0.062
	Humor	-0.877 ***	-0.934 ***
	Interaction	0.013	0.024
	Landscape	0.047	0.023
	Portrait	-0.027	0.043
	Science-fiction/high-tech	-0.222	-0.294
	War/Violence	-0.185	-0.132
Number of famous heroes		0.165	0.217 **
Constant		7.758 ***	7.695 ***
F		7.1	7.50
R2		0.696	0.707
Adjusted R2		0.598	0.613
Number of observations		124	124

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

Model 1 focusing on the liking index of consensus (*Liking-VALCONS*) shows that positive liking consensus among experts has a highly significant and positive effect upon artwork prices, while positive liking consensus among non-experts has the opposite effect. Model 2 targeting emotional consensus (*Emotion-VALCONS*) corroborates this finding, revealing that positive emotion consensus among art experts plays a significant and positive role in explaining auction prices. On the contrary, positive emotional consensus among non-experts about artworks has a highly negative effect on these artworks prices. These findings supports H1, as both our perception indexes have a statistically significant effect on auction prices. H2a is confirmed, as our results show that auction prices reflect consensus on perceptions of market insiders. However, our results do not support H2b, since we observe that auction prices also reflect consensus on perceptions of market outsiders.

These estimates bring novel and interesting results. First, liking and emotional consensus are differently reflected in prices depending on the social group from which they are issued. This finding can be explained in the light of other results in the literature, that demonstrate that the degree of liking and emotional responses elicited by art exposure differ depending on the level of expertise (Cupchik and Winston 1992, Leder et al. 2012, Leder et al. 2014). If patterns of liking and emotion are conditioned by the social group subject to art exposure, so do the values of our liking and emotion consensus indexes and in turn their contribution in explaining prices. Indeed, art expertise affects the way individuals look at artworks and, more precisely, changes individuals' evaluation process, expectations, perception and preferences for art (Cupchik and Gebotys 1988, Cupchik and Winston 1992, Vogt and Magnussen 2007, Ylitalo et al. 2016, among others). This phenomenon leads to differences in the set of references that trained and untrained viewers bring to their judgement process. Artworks qualities taken into account in the art stimulus appraisal depend on the subject's experience. Our results show that collectors, who acquired comic art knowledge, share a common set of standards which does not spread to outsiders.

Second, we observe that artworks generally achieve higher prices when they are consensually liked by collectors and eliciting positive emotion to them, as expected in H2a. This finding shows the existence of consensus among art collectors, which means comic art market players have integrated aesthetic principles about what is considered as "good art". The comic art market appears thus to be a codified market where stakeholders tend to assess artworks similarly according to established canons. In that sense, experts judgements are biased by acknowledged standards, criteria of what is likeable are completely changed with expertise.

Finally, it is the insiders who influence the market and the closer an artwork is from their principles and what they think is good art, the higher is the price.

Third, estimations of Models 1 and 2 indicate that real auctions prices of artworks are significantly lower the more lay viewers agree on the fact that they like them and feel emotionally positive while viewing them. This finding can be considered as unexpected and controverts H2b. One would think that outsiders' opinions are not relevant when explaining market prices, so that we would have observed no significant influences of non-experts liking and emotion consensus on final purchase prices of artworks. Besides, this finding does not support the hypothesis that "universal beauty" – what is liked by all or elicits positive emotion to all – results in higher observed prices, as an increase in the price of our sampled artworks results from positive subjective perceptions of some individuals (experts) and negative subjective perceptions of others (non-experts). Rather, this result clearly shows that non-experts do not have the codes required to recognize "good art" that reaches high prices. This provides corroboratory evidence for the result of Winston and Cupchik (1992), namely that experienced viewers prefer high art, while naïve viewers prefer popular art. Indeed, they found that "*naive viewers liked popular art and disliked high art works, while experiences viewers showed the reserve pattern*". This discrepancy is due to distinct basis for their judgements. Naïve viewers emphasize affective dimensions such as pleasantness and warmth in their judgements of art and rate popular art as more pleasant and warmer than high art. Experienced viewers focus on objective and expressive qualities of artworks such as structural complexity for their art appraisals and find high art more complex than popular art. These two contrasting grounds for art assessment lead to two different conceptions and beliefs of the purpose of art. Experienced viewers consider that art should challenge our view of the world and require intense processing effort from the viewers, whereas naïve subjects consider that art should provide immediate positive feelings to a large number of people. Finally, as other markets, the art market is subject to fads (Pénasse et al. 2014), defined as "*mean-reverting deviations from intrinsic value caused by social or psychological forces*" (Camerer 1989), which also explains that outsiders are not aware of what kind of art is considered as high art and valuable by market insiders nowadays.

We can conclude that our results contradict Graham et al.'s assumption (2010) that "*it seems reasonable that efforts to appeal to a shared human aesthetics are responsible for at least part of a work's value*". Shared positive appreciation or emotion from insiders and outsiders do not contribute to prices, but instead the latter are explained by restricted appreciation and emotion from insiders, which go in the opposite direction with respect to outsiders' judgements. What is liked by or elicits positive emotions to novice subjects, *i.e.*

ordinary people, generally results in decreases in artwork prices. This is in line with Bourdieu's assumption (1979), namely that individuals engaging in art are driven by an individualisation process through which they tend to stand out from the others.

4.2. Individual differences (collectors vs. non-collectors) in making judgements

As our results have shown that experts and non-experts achieve opposite consensus on liking judgement of art and emotional responses to art, we investigate in this section which dimensions, *i.e.* attributes of artworks, govern experts and non-experts judgements and if there are differences in the salience of particular dimensions between insiders and outsiders. To do so, we model consensus on liking and emotional judgements. More precisely, we first regress the consensus on liking (*Liking-VALCONS)* of insiders (Model 3, Equation 3) and outsiders (Model 4, Equation 4) on a set of artwork's attributes. Second, we regress the consensus on emotion (*Emotion-VALCONS*) of insiders (Model 5, Equation 5) and outsiders (Model 6, Equation 6) on the same set of artwork's attributes. The purpose is to determine social groups' relative valuation of these characteristics involved in the perception of art. The models are as follows:

$$Liking\text{-}VALCONS\text{-}insiders_i = e + \sum_j Artist_{j,i} f_j + \sum_k Artwork_{k,i} g_k + \varepsilon_{3,i} \quad (3)$$

$$Liking\text{-}VALCONS\text{-}outsiders_i = h + \sum_j Artist_{j,i} p_j + \sum_k Artwork_{k,i} q_k + \varepsilon_{4,i} \quad (4)$$

$$Emotion\text{-}VALCONS\text{-}insiders_i = r + \sum_j Artist_{j,i} s_j + \sum_k Artwork_{k,i} t_k + \varepsilon_{5,i} \quad (5)$$

$$Emotion\text{-}VALCONS\text{-}outsiders_i = u + \sum_j Artist_{j,i} v_j + \sum_k Artwork_{k,i} w_k + \varepsilon_{6,i} \quad (6)$$

where *Liking-VALCONS-insiders*, *Liking-VALCONS-outsiders*, *Emotion-VALCONS-insiders* and *Emotion-VALCONS-outsiders* are our indexes of consensus on liking and emotion of artwork *i (i* = 1, …, *N)* for both social groups, $Artist_{j,i}$ is the measurable artist-related attribute

j *(j* = 1, …, *J)* of artwork i, $Artwork_{k,i}$ is artwork-specific feature k (*k*=1, …, *K)*, f, g, p, q, s, t, v and w are unknown coefficients, $\varepsilon_{3,i}$, $\varepsilon_{4,i}$, $\varepsilon_{5,i}$, and $\varepsilon_{6,i}$ are the error terms.

We include the same artist's and artworks' attributes in specifications (3) to (6) than those included as control variables in the auction price regressions, apart from the artworks' size. Indeed, the influence of the artwork size on art prices is a finding that has been generated for a while by economists in the art market field, so that it was a necessity to include size as a control variable for auction prices. However, in our questionnaire sent to experts and nonexperts, sizes of all artworks' images were adjusted to fit to a width of 400 (in units used by Limesurvey©), so that respondents could not have been influenced by the number of square centimetres in their ratings. Therefore, it makes no sense to include real artworks' sizes as an explanatory variable in specifications (3) to (6). We will first analyse the determinants of consensus on liking (4.3.1) and then of consensus on emotions (4.3.2).

4.2.1. Explaining liking judgement

Table 5 shows the determinants of insiders' and outsiders' consensus on liking. Model 3 has the consensus on liking of experts as dependent variable (*Liking-VALCONS-insiders)* and Model 4 explains the consensus on liking of non-experts (*Liking-VALCONS-outsiders*).

The first significant difference and probably the most interesting result revealed in Table 5 is that art liking of collectors increases with the artist's recognition (measured by the fact that the artist has been honoured by an award for his/her career) whereas for non-collectors, art liking decreases with the artist's recognition. This result clearly shows that experts recognize the artists behind the artworks they had seen and know about their respective reputation so that their preferences agree and match with the artist's recognition. On the contrary, nonexperts' preferences reveal an opposite pattern of liking, which indicates that nonexperts do not share at all the market standards. What is more, we observe that black and white artworks enhance significantly experts' consensus on liking for these stimuli, without having any influence on non-experts' judgements of liking. Again, this result shows that collectors have integrated this monochrome form as being a norm of "high art", superior to colored comic art. Indeed, black and white artworks are more frequent than colored artworks on the comic art market and reflect comic culture more, for the reason that comic artists have been largely working in black and white. For close reasons, experts' consensus on liking is negatively impacted by pasting and mixed medium compared to ink, the latter being the traditional medium used.

However, we also find characteristics that influence liking consensus of insiders and outsiders similarly. The number of publications contribute positively to both experts and nonexperts' judgement, while being more significant for experts. In other words, the more an artwork has been published in the form of comic books, the more it is liked by experts and non-experts. The number of publications reveals the commercial success, because reprints of a first edition of a comic book mean that it has been appreciated by the readers. As insiders' preferences go hand in hand with outsiders' preferences, insiders this time do not overlook what is appreciated by the public in order to set themselves apart from the mass. Regarding outsiders, since readers of comic books represent a much greater audience than collectors, it comes as no surprise that non-experts like what has been a public success. Last, the coefficient is almost twice higher for experts than for non-experts, so that the effect of commercial success on liking consensus is greater for experts than for non-experts. This can be explained by the greater awareness of experts of the popularity of comic books. In line with this result, Table 5 indicates that both social groups' liking is positively related to the number of famous heroes depicted in the artwork. This variable – the number of heroes which is weighted by the fame of the hero – reflects the notoriety of the hero measured with rankings on Amazon©. This result suggests that the hero is a universally liked dimension, the more it is displayed, the more the artwork is liked by all, which is explained by the fact that it is the hero's presence that definitely leads the story. As for the commercial success, the coefficient is twice bigger for the insider group than for the outsider group. Finally, consensus on preferences of experts and nonexperts converge on the illustration medium and on two subject matters depicted in artworks: the landscape topic enhances liking for both social groups, whereas the adventure/suspense topic has the adverse effect. The positive effect on liking of the illustration medium and the landscape topic is bigger for outsiders than insiders, while the negative effect of the adventure/suspense topic is lower for outsiders than insiders.

Table 5 Dependent variable: consensus on artworks' liking of insiders and outsiders (*Liking-VALCONS-insiders* ; *Liking-VALCONS-outsiders*)

Variables		**Model 3** *Liking-VALCONS - insiders*	**Model 4** *Liking-VALCONS - outsiders*
Length of the biography		0.013	0.007
Artist's Award (0/1)		0.044 *	-0.056 **
Number of publications		0.044 ***	0.029 *
Death (0/1)		0.025	0.011
Signature (0/1)		-0.039 *	-0.001
Condition (0/1)		-0.038	0.016
Type (0/1) :	Coverpage	0.028	0.005
	Illustration	0.069 *	0.100 ***
Medium (0/1):	Paint	0.022	0.010
	Pencil	0.020	0.037
	Pasting/mixedmedium	-0.063 **	-0.043
Color (0/1): Black and white		0.105 ***	0.025
Subject matter (0/1): Action		0.019	0.012
	Adventure/suspense	-0.060 **	-0.043 *
	Archetypes	0.022	0.007
	Arts	-0.028	0.011
	Erotism	-0.026	-0.050
	Fantasy/Magic	-0.021	-0.040
	Genre	-0.014	-0.012
	Historical context	-0.014	0.008
	Humor	-0.012	-0.033
	Interaction	-0.045 *	-0.025
	Landscape	0.056 *	0.076 ***
	Portrait	0.041	0.023
	Science-fiction/high-tech	-0.036	-0.022
	War/Violence	0.001	-0.014
Number of famous heroes		0.045 ***	0.020 *
Constant		-0.136 *	-0.005
F		4.70	3.04
R2		0.569	0.461
Adjusted R2		0.448	0.310
Number of observations		124	124

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

4.2.2. Measuring emotional judgement

Table 6 focuses on what makes experts' and non-experts' consensus on emotion. Model 5 has the consensus on emotions of insiders as dependent variable (*Emotion-VALCONS-insiders)* and Model 6 explains the consensus on liking of outsiders (*Emotion-VALCONS-outsiders*).

Table 6 Dependent variable: consensus on artworks' evoked emotion of insiders and outsiders (*Emotion-VALCONS-insiders* ; *Emotion-VALCONS-outsiders*)

Variables		**Model 5** ***Emotion-VALCONS - insiders***	**Model 6** ***Emotion-VALCONS - outsiders***
Length of the biography		0.007	-0.005
Artist's Award (0/1)		0.034	-0.044 **
Number of publications		0.025 *	0.002
Death (0/1)		0.014	-0.002
Signature (0/1)		-0.045 **	-0.043 **
Condition (0/1)		-0.028	0.009
Type (0/1) :	Coverpage	0.025	0.014
	Illustration	0.085 **	0.122 ***
Medium (0/1):	Paint	0.013	-0.003
	Pencil	0.024	0.026
	Pasting/mixedmedium	-0.053 **	-0.015
Color (0/1): Black and white		0.094 ***	0.037
Subject matter (0/1): Action		0.009	-0.017
	Adventure/suspense	-0.038	-0.018
	Archetypes	0.019	0.014
	Arts	-0.035	-0.014
	Erotism	-0.026	-0.048
	Fantasy/Magic	-0.014	-0.019
	Genre	-0.007	0.007
	Historical context	-0.012	-0.006
	Humor	0.014	0.005
	Interaction	-0.033	-0.013
	Landscape	0.046 *	0.059 **
	Portrait	0.021	0.019
	Science-fiction/high-tech	-0.027	-0.040
	War/Violence	-0.017	-0.032
Number of famous heroes		0.034 ***	0.032 ***
Constant		-0.057	0.089
F		3.53	3.27
R2		0.498	0.479
Adjusted R2		0.357	0.333
Number of observations		124	124

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

Regressions presented in Table 6 regarding emotional valence and intensity reveal some similar pattern to liking. Illustrations convey significantly more positive emotions to both insiders and outsiders than boards, and this effect is more pronounced for outsiders than insiders. Indeed, experts may be more attached to the board medium, which is emblematic of the comic culture, whereas outsiders are more unfamiliar with a unique board taken out of its context (the comic book). Next, the landscape topic evokes positive emotions to all social groups. Again, as for liking, the coefficient is higher for non-experts than experts. We may explain this finding in the light of the study by Cupchik and Winston (1992) who states that lay

viewers, when exposed to art, search for familiar themes and their "personal associations form the basis for aesthetic pleasure", while experienced viewers add a degree of objectivity to the aesthetic experience. Then, a higher number of famous heroes results in higher shared positive emotional responses among experts and non-experts. The magnitude of the effect of the presence of famous heroes is similar for both social groups. Last, the black and white positively influences only the experts' consensus on emotions, whereas pasting and/or mixed medium have the opposite effect.

Nevertheless, we also distinguish that the artwork commercial success (reflected by the number of publications) appeals to experts' positive emotions, but does not have an effect on non-experts emotions. As well, artworks from recognized artists affect outsiders' emotions negatively, additionally to the liking judgement, while these artworks do not trigger particular emotional consensus for insiders.

One puzzling finding of Table 6 is that the presence of a signature results in average in stronger negative emotions shared by experts and non-experts. Unexpected result on signature has also be found in a study by Campos and Barbosa (2008) who found that the presence of a signature negatively affects auction prices.

5. Robustness check

As a robustness check, we also estimate our Equation (2a) and Equation (2b) with weighted consensus of liking and evoked emotions depending on the subjects' comic and art interest, education and knowledge. Thus, we refine the degree of art training of our participants (collectors and non-collectors), by weighting the ratings of our participants by the total number of points they gave on the four Likert scales ranging from 1 to 5 comprised in the art-expertise questionnaire answered prior to the survey. The degree of art and comic art training varies between 4 (no comic or art training at all) and 20 (high knowledge and involvement in comic culture and strong education in arts). Therefore, subjects within each social group – collectors and non-collectors– do not have the same weight. A new consensus index is calculated with weighted means and standard deviations of liking and emotion ratings, that we call *WEIGHTED-VALCONS*, with two variations: *Liking-WEIGHTED-VALCONS* and *Emotion-WEIGHTED-VALCONS*. These alternative indexes of consensus aim at testing the robustness of our findings with respect to possible expertise bias. Table 7 reports results of this robustness test, with Models 7 and 8 that respectively include weighted liking consensus indexes and weighted emotion consensus indexes as explanatory variables of the price. We find

that our baseline results still hold after adding an additional level of precision of the degree of art training. Collectors' liking and emotion consensus indexes show a statistically significant and positive relationship with auction prices whereas non-collectors' liking and emotion consensus indexes exhibit a significant but negative relationship with prices.

Table 7 Dependent variable: (log) price, buyer's commission incl. (N=124)

Variables		**Model 7**	**Model 8**
Liking-WEIGHTED-VALCONS - insiders		4.992 ***	
Liking-WEIGHTED-VALCONS - outsiders		-2.226 **	
Emotion-WEIGHTED-VALCONS - insiders			6.157 ***
Emotion-WEIGHTED-VALCONS - outsiders			-2.737 **
Control variables			
Length of the biography		-0.006	-0.013
Artist's Award (0/1)		0.667 ***	0.694 ***
Number of publications		0.327 **	0.333 **
Death (0/1)		0.157	0.176
Signature (0/1)		0.179	0.164
Size (m2)		0.268 **	0.266 **
Condition (0/1)		0.151	0.120
Type (0/1) :	Coverpage	0.857 **	0.890 ***
	Illustration	0.300	0.227
Medium (0/1):	Paint	-0.185	-0.185
	Pencil	0.437 **	0.375 *
	Pasting/mixedmedium	-0.262	-0.196
Color (0/1): Black and white		-0.252	-0.267
Subject matter (0/1):	Action	-0.119	-0.152
	Adventure/suspense	-0.167	-0.193
	Archetypes	-0.149	-0.148
	Arts	0.903 ***	0.925 ***
	Erotism	-0.150	-0.133
	Fantasy/Magic	0.796 ***	0.817 ***
	Genre	0.223	0.241
	Historical context	0.112	0.055
	Humor	-0.906 ***	-0.971 ***
	Interaction	-0.002	0.024
	Landscape	0.029	0.013
	Portrait	-0.053	0.005
	Science-fiction/high-tech	-0.231	-0.311
	War/Violence	-0.177	-0.136
Number of famous heroes		0.155	0.209 *
Constant		7.722 ***	7.631 ***
F		7.05	7.35
R2		0.695	0.703
Adjusted R2		0.596	0.608
Number of observations		124	124

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

6. Conclusion

Prior to this research, the determinants of art prices that have been explored in the literature were mostly objective artworks' or artists' characteristics as well as context-related variables. Subjective determinants on the contrary have received little attention. This paper aims at casting light on how subjective perceptions – especially consensus on subjective perceptions– are reflected in art auction prices. Based on the few studies that have investigated the relationship between art prices and subjective factors, we hypothesize that consensus on art perceptions is reflected in auction prices. However, studies in psychology and sociology of the arts have shown that subjective perceptions are shaped by social influences; as a consequence, art perceptions differ depending on the social group. More specifically, the level of art expertise involves changes in art perceptions. Therefore, it is likely that art collectors and non-collectors do not share the same preferences and we should distinguish between these two social groups. This leads us to formulate our second hypothesis: consensus on art perceptions of collectors – who are market insiders – are reflected in art prices but those of non-collectors – who are market outsiders – are not.

To test these hypotheses, we collect assessments of collectors and non-collectors on the same artworks, thanks to a questionnaire we built. We focus on the comic art market because it is one of the rare art market for which collectors can be easily reached through an online forum that gathers many of them. It is worth mentioning that our survey includes a particularly large number of participants compared to previous studies on art evaluations. We measure two subjective perceptions: liking and emotional response. In order to measure the consensus on art assessment of our two social groups, insiders and outsiders, we create an index of consensus.

We find a statistically significant relationship between our indexes of consensus on art perceptions (for both social groups) and art prices, which supports our first hypothesis. This result shows the importance of considering subjective perceptions when explaining art prices. Moreover, we find that consensus on liking or positive emotion among insiders play a significant and positive role in explaining auction prices, while consensus on liking or positive emotion among outsiders are negatively reflected in prices at auction. Our second hypothesis is then partially confirmed and partially contradicted. Indeed, it appears that art collectors integrate and share aesthetic references of what can be considered as "high art" and therefore drive art market prices. These common standards turn out to be the opposite of what is generally liked and positively felt by naïve art viewers, *i.e.* ordinary people, supporting Bourdieu's assumption (1979) of a differentiation process underlying people's engagement in arts. It seems

that art prices cannot be understand in large aesthetic terms but rather only in aesthetic codes established by and shared among insiders. In the end, our results contradict the assumption by Graham et al. (2010) that "it seems reasonable that efforts to appeal to a shared human aesthetics are responsible for at least part of a work's value". Delving deeper into the relation between artworks' and artists' characteristics on one side and subjective perceptions on the other, we report a difference between the artworks' and artists' characteristics that influence the liking and emotional judgements of collectors and non-collectors respectively, which explains our main findings.

Finally, our study allows for a better understanding of human perception, shared preferences and the interaction between aesthetic judgements and prices. This paper also opens the way towards future research. In this study, we have considered a particular art market, for which the collectors were accessible. Future research using data from other art markets could explore the influence that subjective perceptions of insiders and outsiders have on other art objects' prices. A comparison between the high-end art market and the low-end art market of the contribution of subjective perceptions to prices would be particularly interesting. Also, our study is focused on the European comic art market, which is mainly located in Belgium and France. Future studies could consider participants from other countries that have different cultural backgrounds. Finally, the effect of other subjective dimensions on art prices could be investigated, for example the degree of comprehension of the art object.

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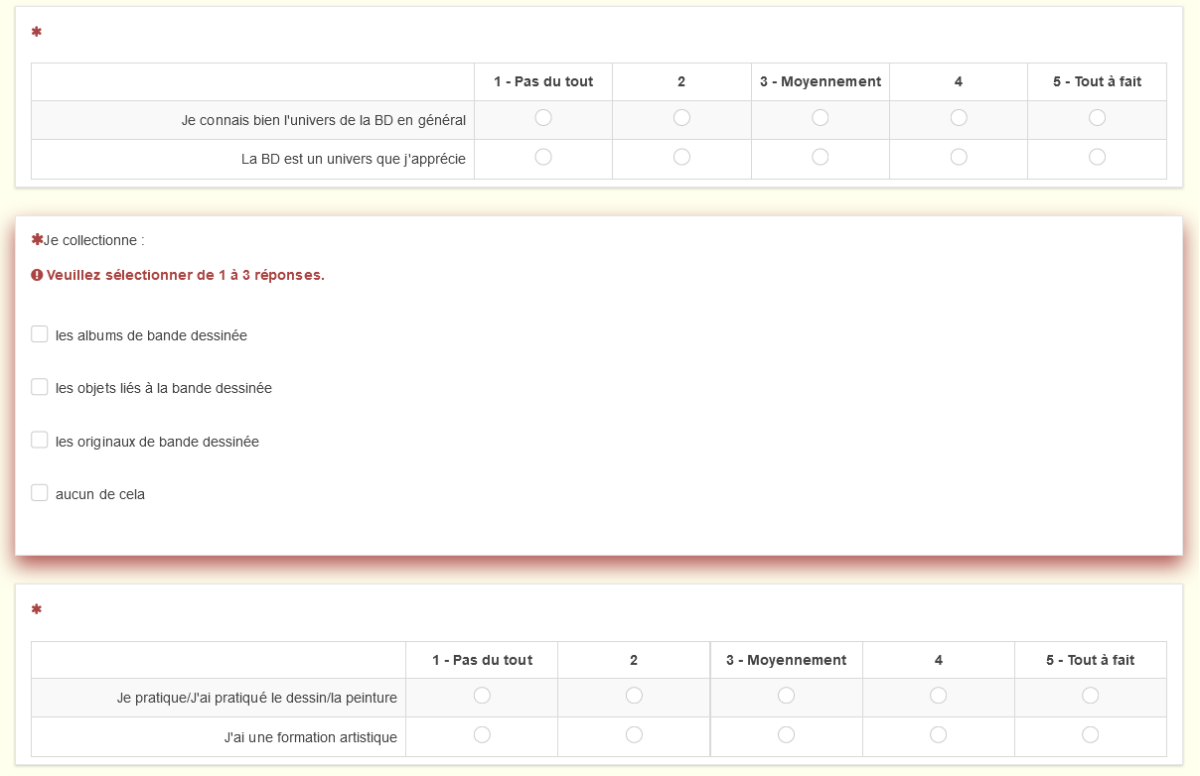
Appendix

Appendix 1.A. Questionnaire for comic art/world interest and art expertise



*

	1 - Pas du tout	2	3 - Moyennement	4	5 - Tout à fait
Je connais bien l'univers de la BD en général	○	○	○	○	○
La BD est un univers que j'apprécie	○	○	○	○	○

*Je collectionne :

Veuillez sélectionner de 1 à 3 réponses.

- ☐ les albums de bande dessinée
- ☐ les objets liés à la bande dessinée
- ☐ les originaux de bande dessinée
- ☐ aucun de cela

*

	1 - Pas du tout	2	3 - Moyennement	4	5 - Tout à fait
Je pratique/J'ai pratiqué le dessin/la peinture	○	○	○	○	○
J'ai une formation artistique	○	○	○	○	○

Appendix 1.B. The questionnaire (some extracts: 6 stimuli)

NB: Stimuli are blurred in order to respect copyrights.

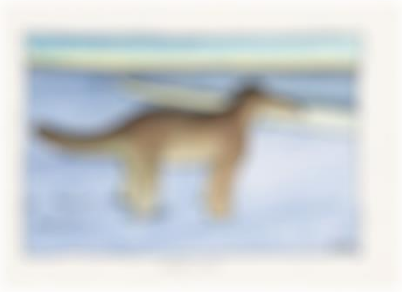
*

Aimez-vous cette oeuvre ?						Vous procure-t-elle une émotion ?				
1 : pas du tout	2	3 : neutre	4	5 : beaucoup		-2 : négative	-1	0 : neutre	1	2 : positive
○	○	○	○	○		○	○	○	○	○

*

Aimez-vous cette oeuvre ?						Vous procure-t-elle une émotion ?				
1 : pas du tout	2	3 : neutre	4	5 : beaucoup		-2 : négative	-1	0 : neutre	1	2 : positive
○	○	○	○	○		○	○	○	○	○

*



Aimez-vous cette oeuvre ?						Vous procure-t-elle une émotion ?				
1 : pas du tout	2	3 : neutre	4	5 : beaucoup		-2 : négative	-1	0 : neutre	1	2 : positive
○	○	○	○	○		○	○	○	○	○

*

Aimez-vous cette oeuvre ?						Vous procure-t-elle une émotion ?				
1 : pas du tout	2	3 : neutre	4	5 : beaucoup		-2 : négative	-1	0 : neutre	1	2 : positive
○	○	○	○	○		○	○	○	○	○

*

Aimez-vous cette oeuvre ?						Vous procure-t-elle une émotion ?				
1 : pas du tout	2	3 : neutre	4	5 : beaucoup		-2 : négative	-1	0 : neutre	1	2 : positive
○	○	○	○	○		○	○	○	○	○

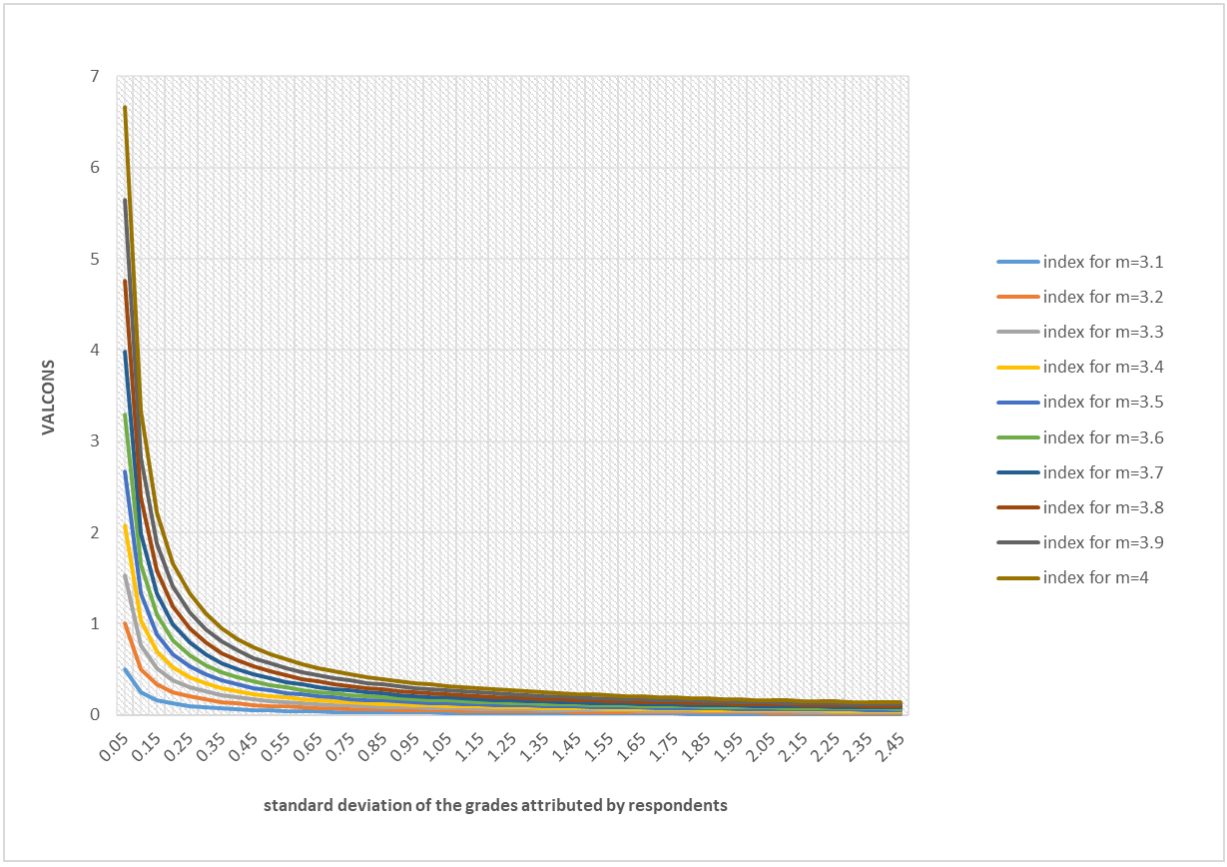
*

Aimez-vous cette oeuvre ?						Vous procure-t-elle une émotion ?				
1 : pas du tout	2	3 : neutre	4	5 : beaucoup		-2 : négative	-1	0 : neutre	1	2 : positive
○	○	○	○	○		○	○	○	○	○

Appendix 2.A. Figure 1: Index of consensus (*VALCONS*) when the mean perception is positive.

This figure shows how the index *VALCONS* behaves when the mean perception (liking or emotion) of a social group is positive. A positive perception of the artwork is indicated by an average rating given by participants between 3.1 and 5. For this figure, the average rating attributed by respondents (either insiders or outsiders) is fixed while the standard deviation (x-axis) evolves between 0 (complete consensus) and 2.5 (large dissensus). We show 10 scenarios of positive average rating: when the mean rating is set at 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, and 4.

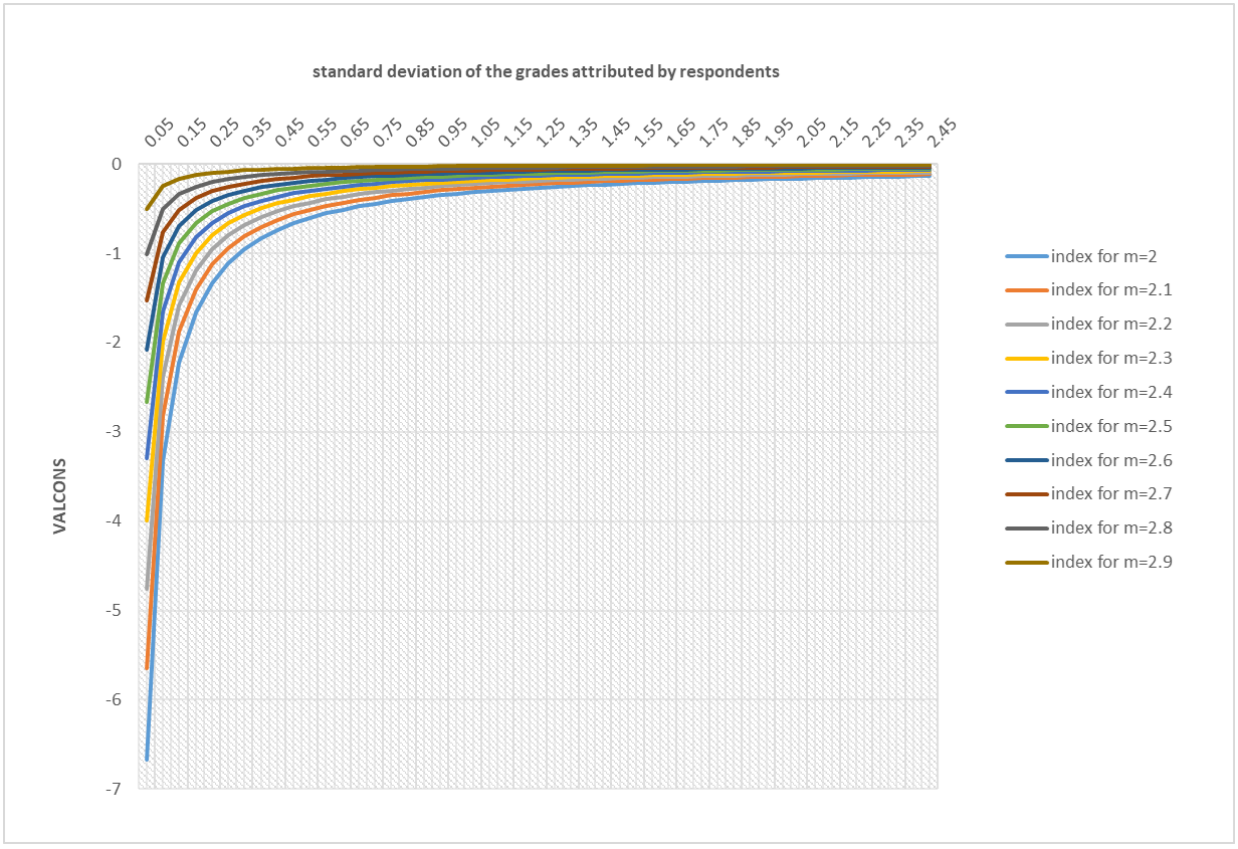
We can see that the higher the mean rating is, the higher is the value taken by the index. Also, the lower is the standard deviation (*i.e.* which means a consensus), the higher is the index. We take the example of an artwork for which the mean rating given by participants is 3.7. If the standard deviation is 0,5 which gives evidence of a relative consensus among participants, the index equals 0,4; whereas if the standard deviation is 2 which rather shows a greater dissensus among participants, the index equals 0,1.



Appendix 2.B. Figure 2: Index of consensus (*VALCONS*) when the mean judgement is rather negative.

This figure shows how the index *VALCONS* behaves when the mean perception (liking or emotion) of a social group is negative. A positive perception of the artwork is indicated by an average rating given by participants between 1 and 2.9. For this figure, the average rating attributed by respondents (either insiders or outsiders) is fixed while the standard deviation (x-axis) evolves between 0 (complete consensus) and 2.5 (large dissensus). We show 10 scenarios of negative average rating: when the mean rating is set at 2, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, and 2.9.

We can see that the lower the mean rating is, the lower is the value taken by the index. Also, the lower is the standard deviation (*i.e.* which means a consensus), the lower is the index. We take the example of an artwork for which the mean rating given by participants is 2.3. If the standard deviation is 0.5 which gives evidence of a consensus among participants, the index equals -0.4; whereas if the standard deviation is 2 which rather shows a greater dissensus among participants, the index equals -0.1.

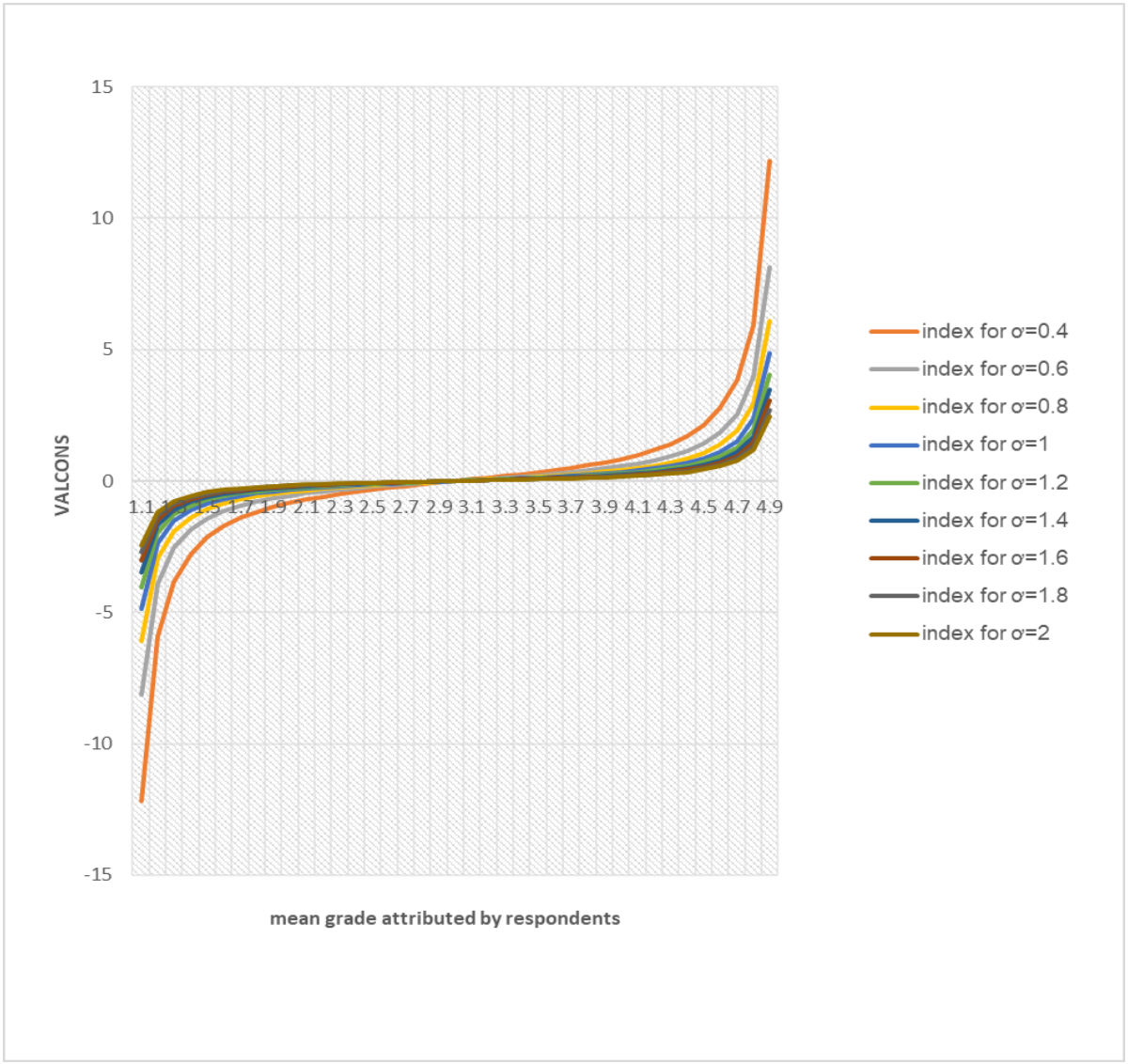


Appendix 2.C. Figure 3: Index of consensus (*VALCONS*) when the level of consensus is fixed.

This figure shows how the index *VALCONS* behaves when the standard deviation of the ratings (*i.e.* the level of consensus on liking or on emotion) of a social group is fixed. A consensus is indicated by a low standard deviation and a dissensus is indicated by a high standard deviation. For this figure, the standard deviation is fixed while the mean rating of participants (x-axis) evolves between 1 (absolute disliking or high negative emotion) and 5 (absolute liking or high positive emotion). We show 9 scenarios of standard deviation: when the standard deviation is set at 0.4, 0.6, 0.8, 1, 1.2, 1.4, 1.6, 1.8, and 2.

We can see that the lower the standard deviation is, the higher is value taken by the index. Also, the higher is the mean rating, the higher is the index. Symmetrically, the lower is the mean rating, the lower is the index.

Let us take the example of an artwork for which the standard deviation of the ratings given by respondents is 1. If the mean rating is negative, at 2.2, the index equals -0.24. If the mean rating is positive, at 3.8, the index equals 0.24.


15
10
5
0
-5
-10
-15
VALCONS
1.1 1.3 1.5 1.7 1.9 2.1 2.3 2.5 2.7 2.9 3.1 3.3 3.5 3.7 3.9 4.1 4.3 4.5 4.7 4.9
mean grade attributed by respondents
index for σ=0.4
index for σ=0.6
index for σ=0.8
index for σ=1
index for σ=1.2
index for σ=1.4
index for σ=1.6
index for σ=1.8
index for σ=2

Appendix 3. Variable definitions

Variable	Definition
Price buyer's premium incl.	Price buyer's premium incl. is the natural logarithm of the purchase price (hammer price and all fees included) in Euros
Liking-VALCONS - insiders	Liking-VALCONS - insiders is the index of consensus on liking of insiders on the lot. The index of consensus is calculated according to formula (1), using the average liking rating given by insiders on the lot and the standard deviation of the liking ratings given by insiders on the lot.
Liking-VALCONS - outsiders	Liking-VALCONS - outsiders is the index of consensus on liking of outsiders on the lot. The index of consensus is calculated according to formula (1), using the average liking rating given by outsiders on the lot and the standard deviation of the liking ratings given by outsiders on the lot.
Emotion-VALCONS - insiders	Emotion-VALCONS - insiders is the index of consensus on emotion of insiders on the lot. The index of consensus is calculated according to formula (1), using the average emotion rating given by insiders on the lot and the standard deviation of the emotion ratings given by insiders on the lot.
Emotion-VALCONS - outsiders	Emotion-VALCONS - outsiders is the index of consensus on emotion of outsiders on the lot. The index of consensus is calculated according to formula (1), using the average emotion rating given by outsiders on the lot and the standard deviation of the emotion ratings given by outsiders on the lot.
Length of the biography	Length of the biography is the number of words in the artist biography found on Bédéthèque website.
Artist's Award (0/1)	Artist's Award (0/1) is a dummy variable equaling one if the artist has been honoured by an award for her/his career (Grand Prix de la ville d'Angoulême), 0 otherwise.
Number of publications	Number of publications is the number of times the comic book (from which the artwork comes) has been published, including the foreign language editions.
Death (0/1)	Death (0/1) is a dummy variable equaling one if the artist is dead at the time of the auction sale, 0 otherwise.
Signature (0/1)	Signature (0/1) is a dummy variable equaling one if the artwork is signed, 0 otherwise.
Size (m2)	Size (m2) is the size of the artwork in square meters.

Condition (0/1)	Condition (0/1) is a dummy variable equaling one if the artwork is damaged (retouching, patches, tears, yellowing etc, 0 otherwise.), 0 otherwise.
Board	Board is a dummy variable equaling one if the artwork is a board or a strip (which is a part of a board), 0 otherwise.
Coverpage	Coverpage is a dummy variable equaling one if the artwork is a coverpage, 0 otherwise.
Illustration	Illustration is a dummy variable equaling one if the artwork is an illustration, 0 otherwise.
Ink	Ink is a dummy variable equaling one if one of the medium used for the artwork is ink, 0 otherwise.
Paint	Paint is a dummy variable equaling one if one of the medium used for the artwork is paint, 0 otherwise.
Pencil	Pencil is a dummy variable equaling one if one of the medium used for the artwork is pencil, 0 otherwise.
Pasting/mixedmedium	Pasting/mixedmedium is a dummy variable equaling one if one of the medium used for the artwork is pasting or mixed medium, 0 otherwise.
Black and white	Black and white is a dummy variable equaling one if the artwork is in black and white (no colour), 0 otherwise.
Action	Action is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to action, 0 otherwise.
Adventure/suspense	Adventure/suspense is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to adventure or suspense, 0 otherwise.
Archetypes	Archetypes is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to archetypes, 0 otherwise.
Arts	Arts is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to the arts, 0 otherwise.
Erotism	Erotism is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to erotism, 0 otherwise.
Fantasy/Magic	Fantasy/Magic is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to fantasy or magic, 0 otherwise.
Genre	Genre is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to genre scenes, 0 otherwise.

Historical context	Historical context is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to historical context, 0 otherwise.
Humor	Humor is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to humor, 0 otherwise.
Interaction	Interaction is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to interaction, 0 otherwise.
Landscape	Landscape is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to landscape, 0 otherwise.
Portrait	Portrait is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to portrait, 0 otherwise.
Science-fiction/high-tech	Science-fiction/high-tech is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to science fiction or high technologies, 0 otherwise.
War/Violence	War/Violence is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to war or violence, 0 otherwise.
Number of famous heroes	Number of famous heroes is the number of times the hero(es) is/are displayed in the artwork weighted by the Amazon ranking of the album from which they originate.

Chapter 3:

Auction hosts: are they really super partes?

Abstract:

This study provides the first examination of the impacts *i)* of marketing strategies implemented by auction houses and *ii)* of auctioneers' way of conducting auctions, on auction sale outcomes: the probability of sale, the final purchase price and the final price in percentage of the pre-sale mean estimated price. Using video recordings of art auction sales and a hand-collected database of 1101 auctioned artworks, we find firstly that the organisational and promotional work carried out by auction houses has an impact on different sale outcomes and secondly that the auctioneers' behavior seems to be decisive, especially the usage of humor. This research brings a more comprehensive understanding of bidders' behavior, the tactics through which auction houses and auctioneers affect outcomes, and the functioning of real-world auction markets. Moreover, the findings of this study yield useful managerial insights for marketers.

Keywords: *Auctioneer, strategy, pricing, art market.*

1. Introduction

"*In the back of my head, I'm not just representing Christie's. I'm representing […] all the staff who've got a piece consigned. […] An awful lot of people go into the moment when I get up, and if I'm not on good form, all their hard work isn't maximised*" explained Hugh Edmeades, auctioneer at Christie's for 35 years[1]. This auctioneer recognizes the importance of marketing efforts in the auction house's activity and of the auctioneer performance when conducting an auction sale. Auctioning seems thus to be more than simply collecting pieces from sellers and put them for sale, calling the prices and being a money-collecting robot.

An auction is a common market mechanism with a defined set of rules used for allocating and pricing resources (McAfee and McMillan 1987). A wide and increasing range of markets are concerned, the most renowned being spectrum license, flowers in Holland, art and antiques, and Internet consumer auctions such as eBay. A large body of academic research has mostly discuss auctions formats and revenues, sellers' and bidders' behavior at auction, depending on the auction's rules. Less have been done on the auction sale intermediary, *i.e.* the auction host, and especially few in marketing. It appears regularly in real auctions but also in the relevant literature that the seller holds the role of the auctioning agent, hence there is no third party. When there is an auction host, it can be online auction websites or brick-and-mortar auction houses for which a human professional auctioneer conducts auction sales. This paper empirically explores the impacts of marketing strategies implemented by auctions houses and human auctioneers[2] on sale rates, on prices realized at auction, but also on the difference between the auction price and the pre-sale estimated price. Auction houses are independent businesses with their own interests that aim at maximising their profits. While actual auction houses and auctioneers practises have received little attention by the management science literature, our question is whether and, if so, how heterogeneity among auction house organizational and promotional strategies and auctioneers' behavior determine different outcome of artwork transactions, prices or price-estimate ratios for otherwise equivalent art pieces. To do so, we answer to three sub-questions that are still to be investigated: Should auction houses care about the organisation of a sale and on what should they focus specifically? Is there a way to present or show off the works they have to sell in order to maximize revenues?

[1] The National, 02/05/2020. Hugh Edmeades has proceeded to more than 2 600 auctions, selling more than 310 000 lots for more than 2,75 billion of dollars.

[2] It is common to find in the literature the term "auctioneer" indistinguishable from the seller or to designate the auctioning agent (Hossain et al. 2013). In this paper, we call "auction house" a firm that auctions (at least partly) on-site, "auction platform" a firm that organises online auction sales (such as eBay) and "auctioneer" the human professional in charge of conducting oral outcry auctions.

Does the behavior of professional auctioneers have an impact on the outcome of items transactions and prices?

While this article draws upon two disciplines, marketing and economics, that both enrich our understanding of auctions, these questions will be answered from a marketing perspective. We use data from English ascending auctions and apply our study to art market auction sales conducted by six different auction houses between March 2017 and May 2018 in Europe.

Our results show that auction house should give particular attention to the organization of the sale, as many effects exert an influence upon probability of sale and prices, like the level of competition with similar sales or the number of lots from the same artist. We find that the promotional work performed by auction houses has a significant and positive influence upon artwork prices, with the written positive comment ahead of the sale proving to be particularly decisive. Last, we observe a noteworthy influence of the auctioneer's interventions on outcomes. First, we find that the usage of humor by the auctioneer plays a relevant role in explaining sale probability and auction prices. Second, the price-estimate ratio turns out to be mostly determined by the auctioneer's behavior, whose role of salesman appears to be crucial in selling an entertaining auction experience to bidders in an atmosphere of trust.

The paper is organized in the following manner. Section 2 provides a review of the literature on the impact of auction hosts and develops the hypotheses. In section 3 we describe our data set and methodology. Section 4 presents our results and analysis. Finally, conclusion, implications and future research on auctioning agent are stated in section 5.

2. Existing auction host research and hypotheses

Since the 1961 seminal article of Vickrey, there has been a body of research about auction theory, questioning auction formats, auction revenues and optimal strategies for bidders (see Klemperer 1999 for a survey). However, the existing literature has given less attention to the third player of an auction sale: the auctioning agent, especially from a marketing perspective. In many studies, no distinction is made between the seller and the auctioneer or this later is considered as a passive intermediary between the seller and the buyer. Auction hosts are companies that sell a marketplace for transactions between sellers and buyers. These intermediaries are in charge of connecting both parties, while being independent from them.

An auction host can take several actions that can have a notable economic impact. First of all, the auction host can influence outcomes by choosing auction format. Different auction types can be used, four basic types are widely adopted: the first-price sealed-bid auction, the second-price sealed-bid auction (also called the Vickrey auction), the ascending-bid auction (also called the open or English auction) and the descending-bid auction (also called the Dutch auction). The difference in realized prices depending on the auction format has been explored mostly theoretically. If bidders are risk-neutral and their valuation are independent, the expected selling price is the same for these four auction types (Vickrey 1961, Myerson 1981, Riley and Samuelson 1981). But, with risk aversion, the Dutch and first-price sealed-bid auctions yields larger expected prices than the English and second-price sealed-bid auctions do (Harris and Raviv 1981, Holt 1980, Matthews 1980, Maskin and Riley 1980). Likewise, if bidders' valuations are not independent, the English auction produces higher prices than the second-price auction format, which in turn leads to higher prices than the Dutch and first-price auctions (Milgrom and Weber 1982). Also, asymmetries between bidders, even small, can substantially reduce the price paid by the winning bidder (Klemperer 1998). As we can see, the choice of an auction format by an auctioneer has major significance on realized prices, depending on bidders', sellers' and goods' characteristics. In practise however, in anchored and historical markets such as art and antiques, an auction house does not choose the auction format. The English auction format has been the historical format used for centuries. Furthermore, the auctioneer can intervene on the nature of bidding. For ascending-bid auctions, either the auctioneer raises prices continuously and bidders exit the auction gradually, or bidders submit by their own higher prices successively, thus allowing for jump bidding (submitting bids higher than the increment required by the auctioneer). These two bidding manners do not yield the same actual prices as shown with experiments by Isaac et al. (2005) who recommend auctioneers to allow bidders to place jump bids or to make a careful choice of the bid increment. He and Popkowski Leszczyc (2013) who conducted two studies in a real-world setting find a positive correlation between jump bidding and ending prices.

Second, the auction host is in relation with both the seller and the buyer and get paid by both of them. Indeed, auction hosts earn revenues by charging commissions on buyers and sellers, *i.e.* a certain percentage of the price realized at auction. Ginsburgh et al. (2010) show that changing the levels of buyer's and seller's commission rates matters for the outcome. They find that when increasing both seller and buyer commission rates, the seller is worse off when

buyers can be better off. This is due to the correlation between level of commissions, seller's reserve price and buyers participation.

When considering the seller side only, on art and antiques market, this commission rate is subject to a negotiation between the auction house and the seller, as auction houses compete on the seller's side to obtain the best items for sale. But on Internet auctions market, the seller fees and commissions are not negotiable and online auction companies are free to determine their levels. Sellers have to pay a fixed fee to list their item (whether or not it is sold), and if the auction successfully concludes, sellers must pay a commission rate charged by the online auction platform. Yao and Mela (2008) argue that in general, revenues increase with higher fees (a uniform pricing strategy) and lower commissions (a form of high-value price discrimination). Indeed, they explain that as fees rise, seller profits decrease which dissuade sellers to list items. Bidders encounter less auction sales so they bid on fewer goods but increase their bids to win. When proceeding to commission reductions, the auction house attracts high-value sellers, because their profit per item increases, which results in higher gross volume sold on the website that compensates revenue losses due to commission reduction for the auctioning agent. A close practise used by auction houses is to apply buy-in penalties, that is a fixed amount defined in advance that the seller must pay to the auction firm in the case the item does not get sold. Greenleaf and Sinha (1996) find that these penalties combined with lower commissions is a Pareto-dominant strategy compared to the strategy of higher commissions without buy-in penalties. Indeed, lower commission and a buy-in penalty motivate sellers to set lower reserve prices, which increase total expected auction revenue.

Linked to the seller's reserve price, another mean on which auction houses have influence are pre-sale price estimates publicly given by auction houses. Pre-sale estimates generally include a low and high price estimate of the items which will be presented at auction. These pre-sale estimates stem from a compromise between the seller and the auction house. Indeed, as the seller's reserve price cannot be above the low price estimate, the seller tends to push the estimation upward to ensure the highest minimal price. As for auction houses, they aim at shifting price estimates downward in order to attract buyers, while they have to satisfy the seller with a sufficient price (Louargand and McDaniel 1991). A great number of research has focused on pre-sale estimates and their accuracy to predict actual prices. Ashenfelter (1989) first finds that pre-auction estimates predict well the obtained prices, corroborating Milgrom and Weber (1982)'s model that "*honesty if the best policy*". However, most empirical studies show consistent biases in pre-sale estimates. For example, Beggs and Graddy (1997) observe that recently executed contemporary art is systematically overvalued, while longer and wider

paintings are undervalued. Mei and Moses (2005) find that pre-sale price estimates of expensive paintings are subject to a consistent upward bias over a long period of 30 years. They suggest that this result can be explained by art dealers or auction house advising their clients to buy the most expensive artworks they can afford (*i.e.* with the highest estimated prices), presuming that "masterpieces" outperform the market. Indeed, as auction houses are paid by the seller's commission and the buyer's premium based on the realized price, the higher the price, the higher the auction house's overall returns. Art buyers are influenced by pre-sale price estimates when they think about the maximum price they want to pay for artworks and are likely to pay more for an artwork with a high price estimate. Ekelund et al. (2013), who control for selection bias, find that price estimates of early twentieth-century American artists over 20 years are biased downward and underestimates become greater with the value of the artwork. Their explanations are twofold. Firstly, if estimates are lower, more buyers are attracted and the auction house has more chance to maximise its revenues by selling more as seller's reserves are lower. Secondly, sellers experience a satisfying surprise if they receive a price that exceeds the expected price based on estimates and are consequently more likely to offer further items for sale to the auction host, which in turn should result in increased sales and profit levels (Palmatier et al. 2008).

Another tool that is sometimes used by auction houses in order to attract sellers is price guarantees. In a guaranteed auctions, the auction house guarantees the seller a minimum price whatever the sale outcome. If the highest bid does not exceed the seller's reserve price, the auction house pays the guarantee to the seller and become the owner of the good. If bids exceed the seller's reserve price, the auction house gets a higher commission (*i.e.* in addition to the regular seller commission) on the share above the guaranteed price. The guarantee amount and commission are the result of a negotiation between the seller and the auction house. The main result of Greenleaf et al. (1993) is that price guarantees increase expected revenues for sellers whereas lower the expected payoff for the auction house compared to traditional auction, but allows the auction house to retain the seller's business. Greenleaf et al. (2002) explain this result as the consequence of the seller's capacity to negotiate guarantees and commissions, not as the consequence of the guarantee *per se*.

We now turn our attention to the buyer side to examine buyer's premium. Buyer's commission is not subject to bargain and auction houses can take advantage of their power on buyer's premia. This buyer's premium is part of a partitioned pricing strategy (*i.e.* dividing a product's price into two or more mandatory parts). Indeed, buyer's premia can increase auction

prices as many bidders do not completely or accurately process partitioned prices (Morwitz et al. 1998).

It can finally be noted that there are differences in terms of auction outcomes depending on the auction host *per se*. There is evidence that prices paid by buyers are systematically higher at certain auction houses and locations because of their attractiveness (see for example Renneboog and Spaenjers 2013 in art market auctions, Ong et al. 2005 in real estate auctions).

Third, once the rules of the auction sales set down by the auction host, all pre-sale activities, *i.e.* the concrete and daily work of the auctioning agent and auctioneer, remain. This is the main focus of our research. It is an important but surprisingly little investigated mean left at the disposal of auction houses and auctioneers. This paper empirically explores some pre-auction organisational and promotional tools of auction houses and tools of auctioneers when conducting the auction sale. We examine both how the pre-sale work by auction houses and the auctioneer's behavior affect the auction outcomes, that is the sale probability, the final auction price and the price differential between average pre-sale estimate and final purchase price.

Before the sale, auction houses perform behind the scenes an organisational work and a promotional work. Organisational work refers to the auction host decision-making on the various modalities regarding the organisation of the sale, such as the choice of when the sale takes place, which and how much of the items are presented for the sale, how lots are constituted, or how they are ordered. Promotional actions can be defined as the different ways lots for sale are advertised, presented and praised, for instance with a glowing comment or an in-depth description. Few studies have been dedicated to the study of the impact of auction houses' organisational or promotional work on auction outcomes. One explanation to this lack of auction-research on the concrete work of auction host and auctioneer is the challenge of quantifying this type of information which have to be collected manually in order to meet such a level of detail and costs time, rather than the assumption of unavailable or irrelevant data. We can find some rare variables related to sale organisation and presentation work by auctions houses disseminated in a few studies. For example, with respect to organisational work, organising auction sales some months of the year allows relatively lower or higher auction prices (Agnello and Pierce 1996, Worthington and Higgs 2006, Renneboog and Spaenjers 2013), but does not seem to influence the probability for an item of going sold or unsold (Marinelli and Palomba 2011). Then, Beggs and Graddy (1997), corroborated later by Campos and Barbosa (2008), show that the order of sale have an implication on prices. Indeed, when organising auctions of heterogeneous items, the auction house must deliberately make a

decision about the order in which the items will be auctioned. The two authors show empirically and theoretically that the realized price at auction relative to the pre-sale estimate declines throughout the auction and that auction house' optimal strategy is to order heterogeneous items by declining estimated values. However, Picci and Scorcu (2003) do not find this order of sale effect once employing a dynamic model, while experts in the organisation of auction sales declare mixing items to kick excitement off and maintain it over the course of the auction sale. Regarding the promotional work of the auction house, Agnello and Pierce (1996) and D'Souza and Prentice (2002) find that higher value is placed on artworks when an illustration of the artwork for sale is provided in pre-sale catalogues in addition to information about the item. Yao and Mela (2008) calculates, using six months of Internet auction data for Celtic coins, that the presence of a picture increases item average valuation by $0.54. Moreover, Cinefra et al. (2019) show that a greater length of the lot description, that conveys importance to the item and provides information, command higher prices, *ceteris paribus*. It is undeniable that these marketing efforts require time, energy and therefore increase costs for the auctioning agent so we hypothesize that organisational features affect auction outcomes and that promotional work increase prices. In summary,

> **H1**: *Organisational efforts have an impact on the probability of sale and final auction prices.*
>
> **H2**: *Promotional efforts increase the likelihood for an item of being sold and fetching a high price.*

Over the course of the auction, the auctioneer is in charge of conducting the sale and can contribute significantly to the sale in a variety of ways. The professional auctioneer is free to get more or less involved in the process of the auction and is able to use a variety of strategies in delivering comments or information. The performance of auctioneers have been addressed by socio-linguistic studies that examined the characteristics of their talks (Kuiper 1992, Kuiper and Haggo 1984, Kuiper and Tillis 1986) and other studies have analysed the social interaction between the auctioneer and bidders (Heath and Luff 2007a), the characteristics of auctioneer's gesture and other forms of bodily conduct (Heath and Luff 2007b) or the implications of the strike of a hammer to conclude a contract (Heath and Luff 2013).

This paper aims at exploring the link between the human auctioneer's actions throughout on-site outcry auction sales and the auction outcomes. The question we investigate is whether the human auctioneer's role on stage is market neutral or if rather this party influences the auction outcomes and how, by which intervention's types, which have not been

captured yet in other auction studies. On the one hand, in a competitive bidding system with bidders highly informed about the items for sale, a significant economic impact of auctioneers may appear unlikely.

On the other hand, auctioneer Hugh Edmeades asserts that auctioneer's performance during the auction is determining. Lacetera et al. (2016) confirms this conjecture by measuring a performance variability across auctioneers. They find that auctioneers vary systematically in their effects on auction outcomes (probability of sale and two different price metrics) for otherwise similar cars. The market they study gathers participants who are experienced professionals. They also observe that faster auctioneers tend to achieve better auction outcomes. Without proceeding to a quantitative analysis of the sources of these differences, *i.e.* the tactics employed by auctioneers on stage, they suggest that this heterogeneity stems from disparity in their ability to generate bidder excitement and urgency. Indeed, auction sales are emotionally-charged environments that may give rise to behavioral bias such as auction fever (Häubl and Popkowski Leszczyc 2004, Ockenfels, Reiley, and Sadrieh 2006, Jones 2011, Malmendier and Szeidl 2020). Auction fever is the "*increased emotionality state that is experienced by bidders*" (Adam et al. 2011, p. 205). This emotional state results from high level of arousal (Ku et al. 2005), increased excitement (Lee et al. 2009) and desire to win (Malhotra et al. 2008). When some bidders get caught up in auction fever, "*their emotions block their ability to think clearly*" (Murnighan 2002, p.63) and bidders end up overbidding, *i.e.* calling for prices beyond their initial limit (Murnighan 2002, Ku et al. 2005, Malhotra 2010, Adam et al. 2015). Time pressure, a typical component of auctions generated by the looming deadline, appears to induce increased bidders' arousal that leads individuals to bid above their pre-set valuation, even for experienced bidders (Ku et al. 2005, Malhotra 2010, Adam et al. 2015).

Chipty et al. (2015) describe the oral outcry auction as "a race against the clock", explaining that auctioneers face a time-revenue dilemma. Indeed, bidder attendance varies over time as bidders are commonly only interested in a few items presented for sale, not all of them, so that much of time bidders spend in the auction is usually considered as lost. And an increase in the number of bidders is correlated with higher revenue (Brannman et al. 1987, Bajari and Hortaçsu 2003, Ching and Fu 2003) and higher sale probability (Ong et al. 2005). Meanwhile, the time between bids lengthens as the bid nears the final price (Chipty et al. 2015). The auctioneer is thus confronted with a tradeoff between continuing the bidding on a lot despite the slowdown to maximise revenues on this lot, and closing bidding (even though a higher bid was possible) to allocate time to other lots, whose sale and price might be jeopardized.

What is more, in the context of online auctions, Ducarroz et al. (2016) show that in-process promotions send by auctioning platform have a positive effect on final auction price, confirming that bidders' valuations are impacted by the market environment in online auctions (Chan et al. 2007). In line with these studies, we speculate that each kind of intervention from the professional auctioneer may improve auction outcomes. Thus,

> **H3**: *The various contributions of human auctioneer during the sale are not neutral regarding the propensity for the item to be sold and/or to reach a high price.*

3. Data and methodology

This section first details the sample (3.1.) and how we collect our data (3.2.). Then, we introduce the variables and descriptive statistics (3.3.). We finish by presenting the model (3.4.).

3.1. The sample

The dataset includes 1101 artworks auctioned between March 2017 and May 2018 by six different auctioneers in six different auction houses. There is usually one auctioneer per auction sale, but for one Christie's sale (June 2017), two auctioneers have succeeded one another. As there are many types and styles of artworks on the global art market, acknowledged as extreme case of heterogenous goods, we reduce this variability by considering only one relatively homogeneous art submarket. We include sold and unsold lots in order to avoid any selection bias (Alford et al. 2017). Our focus is on the European comic art market, that is, our observed lots are original comics auctioned in Paris and Brussels. The comic art market is a young and expanding art market which has almost never been studied. We work with cross-sectional data over a one-year period, in order to have the most exhaustive data on this year and the most recent one. It should also be noted that since the comic art market is young, the completeness, the number and the reliability of the information provided by the auction houses have been increasing with the recent years. All main auction houses which regularly organize original comic dedicated sales are represented, apart from Vermot et Associés, since they did not provide all artwork images. The distribution of the sampled lots between the different auction houses follows: Christie's (30,2%), Coutau-Bégarie (14,4%), Cornette de Saint Cyr (18,5%), Artcurial (17,1%), Huberty-Breyne (10%), and Millon (9,8%).

Our dataset focuses on one type of auction format: English ascending auction. Indeed, the ascending auction system is the type of auctions in which auctioneer's strategies have the

most potential to affect the sale, according to Cassady (1967). Thus, our data are drawn from ascending auction in order to explore whether auctioneer's tactics achieve outcomes. The ascending English auction is a popular type of auctions in which the auctioneer opens the auction by announcing a starting price and bidders submit increasingly higher bids until one bidder remains, who buys the item at the price of the highest bid (and to which fees are added). This auction format is also characterized as an open auction mechanism, as the competition between bidders is open, each bidder discovers the bids submitted by others and therefore get information about their valuation.

3.2. Data collection

We compile this unique dataset by collecting by hand all information about pre-sale activities (organisational and promotional) by auctioning firms, auctioneer's oral interventions during the sale, final purchase prices, and items' characteristics to control for heterogeneity between pieces of art.

Our main source of information lies in pre-sale catalogues, as published by the auction houses. In most of art auctions, auction houses provide catalogues to their customers before the sale takes place. Catalogues do not only gather a list of items for sale with their corresponding price estimates: they are also classy hardcover books with high gloss paper that present the artworks for sale, with more or less detailed information (title, artist/school, date, medium, etc.) and sometimes a picture. For one variable related to the organisation of the sale, which measures the degree of competition with other similar sales, we screened the websites of French and Belgian auction houses.

All the sampled auction houses allow live bids through online auction platforms. It is therefore possible to follow auction sales through live video display. We recorded the videos of the sales selected in our sample[3] in order to construct variables related to the auctioneer oral interventions over the course of the auction sale. All sampled sales were transmitted live on the Drouot Live platform, except for the Christie's and Artcurial sales which were transmitted live on their respective live platforms.

This broader approach allows to capture the impact of several aspects of organizational and promotional work of auction houses and auctioneer's strategies on sales and prices, that have received little attention in the literature so far.

[3] We use the software *ActivePresenter*© to record these videos.

3.3. The variables and descriptive statistics

Descriptive statistics are reported in Table 1. Our dependent variables are threefold: the probability of sale (for which a dummy variable is created and equals 1 if the item is sold, 0 otherwise), the (log) price buyer's premium included and the hammer price to mean estimate ratio. In our sample, there are in average 28% of unsold lots per sale, while the average unsold rate of the global art market is 34% in 2017 (Artprice Annual Report, 2017). We choose the price buyer's premium included rather than the hammer price, since it is the price buyers must pay to acquire. The average price (buyer's premium included) for a comic artwork is 7 633 € but the median is much lower (1 877 €) which shows disparity among artworks' prices. One square centimeter of artwork costs in average almost 7 €, while for 50% of our sample, the square centimeter of artwork costs below 1,47 €. Regarding the hammer price in percentage of the mean estimate, the ratio is in average over 1, which means that the sum of artworks prices in our sample exceed all mean estimates aggregated. But less than 50% of artworks hammer prices beat the mean estimate, since the median ratio is 0,94.

Table 1 Descriptive statistics

Variables	N	Mean	Median	Std Dev
Price				
Hammer price (€)	793	6 090	1 500	21 731
Price buyer's premium incl. (€)	793	7 633	1 877	26 587
Hammer price in % of average estimate	793	1.17	0.94	1.02
Price per cm2	792	6.82	1.47	51.62
Organisational variables				
Other sales	1 101	1.71	1	1.32
Sale size	1 101	216.59	192	79.27
Lot order (% of total number of lots)	1 101	0.53	0.55	0.28
Number lots author	1 101	4.38	2	6.22
Subrank author	1 101	2.66	1	3.61
Multiple items lot	1 101	0.06	0	0.24
Lot top-up	1 101	0.10	0	0.30
Presentation variables				
Illustration size	1 101	0.38	0.28	0.42
In-depth introduction	1 101	0.29	0	0.46
Positive comment	1 101	0.45	0	0.50
Auctioneer variables				
Description reading	1 101	0.66	1	0.47
Correction	1 101	0.02	0	0.14
Positive remark	1 101	0.19	0	0.39
Humor	1 101	0.21	0	0.41

In order to test our research questions empirically, we constructed three groups of explanatory variables, regarding i) the sale organisation ii) the presentation of lots in the catalogue iii) the auctioneer's behavior. We included typical variables of control related to artworks characteristics (such as artist's reputation, size, signature, medium and topic, see Appendix 1 for these variables and their definitions).

The organisation of an auction sale includes several aspects that constitute as many steps of decision-making by the auction house. We identify seven of them. The auction house has first to choose a date. It may decide to coordinate with other auction houses, so that it benefits from customer attraction effect due to concentration at the same time of similar sales. But it may also decide to escape competition by scheduling a time with less similar sales. Our variable *Other sales* captures the number of similar sales (*i.e.* auction sales dedicated to original comics) 15 days before and after the sale. Half of our sampled sales are organised close in time with another competing sale or more. Then, the choice concerns the *sale size*: auction houses can decide to make large sales (with several hundreds of lots) or smaller sales (one or two hundred lots). In average, our sampled sales include 217 lots. Smaller sales are often more prestigious sales, with a set of carefully selected artworks, so that we can expect lots of smaller sales to reach higher prices in average. Next, the auction house has to order its lots for sale, and as seen in the literature review, the *lot order* can have an effect on auction outcomes.

When receiving items from sellers, artworks can be from the same artist. From that point, is it a better strategy to sell several works from the same author in the same sale or to spread them over the coming sales? On the one hand, presenting many works from the same author can attract more buyers collecting this artist, and the higher the number of bidders, the higher the price. On the other hand, one can expect that presenting several works from the same artist gives more opportunity to buy one of them, so buyers will fight less as supply is greater. To understand which effect prevails, we add the variable *number lots author* that measures the number of lots from the same author per sale. Half of our lots go with one another work from the same artist or not, while the other half is accompanied by one or more other work from the same artist. The average number of lots from the same artist presented for sale is high (4,38), due to the fact that two out of the seven sales recorded began with a part dedicated to one artist (a few tens of lots). In the case of several works from an artist presented in one sale, it is interesting to analyse if the order of sale among these works from the same author matters. Do bidders especially fight on the first lot(s) for sale by the artist to ensure that they will make at least one purchase by fear of losing the opportunity? Or do bidders start to bid slowly for the first lot(s) presented for sale while becoming more aggressive and bidding more on the last ones

because supply decreases? To answer this question, we include a variable *subrank author* that indicates the rank of the lot out of the lots from the same author. For example, when this variable is equal to 4, it means that there had been three other artworks from the same artist that have been presented for sale previously.

Also, works (from the same author or not) can be sold together or separately. Is a lot including multiple items more likely to sell better or at a higher price? One argument is that gathering artworks in one lot may dissuade buyers to buy them because they could be interested only in one of the items, so they do not want to pay for the other items included in the lot. As the auction house is free to sell only single items, a counter-argument is that these multiple lots have been thoughtfully conceived by the auction house in order to keep items that have common artistic attributes together which would therefore sell better or achieve higher prices than if sold separately. We create the dummy variable *multiple items lot* that equals 1 if the lot consists of more than one item (6% of our sample), 0 otherwise. In addition, several lots come with a top-up attached to the main work such as a drawing on the reverse side or on a separate sheet, for comic art a coloring (a colored separate material), an original edition of the album from which the work is issued or a letter from the artist. The top-up may have a positive effect on auction outcomes because it adds slightly more value to the lot compared to other lots without. The created dummy variable *lot top-up* allows us to test for this effect on sales and prices (10% of items are concerned).

Ahead of the auction sale, the auction house has three means at its disposal to praise lots and inform about their attributes. The presentation and promotion of the lots for sale is done through pre-sale catalogues. The literature has shown that adding a picture of the work for sale has a positive effect on prices, but does the size of this picture matter? And if it is given prominent place on coverpage? We measure the *illustration size* in percentage of the catalogue page, so that if the illustration appears on more than one page, this percentage can be higher than 100%, and if there is no illustration this percentage equals 0%. In average, an illustration occupies 38% of the pre-sale catalogue page. We expect this variable to have a positive impact on prices, as the production and printing of catalogues is costly and as buyers have a clearer view of the lot and may think that if it is printed big or several times the work should be esteemed.

Apart from the picture, the catalogue provides a description of the lot with various information about the artist (name, date of birth/death) and the artwork (date of production, medium, signature, condition, eventually exhibition and provenance). The auction house

decides occasionally to add a whole paragraph of further detailed information about the work itself, the context of production or the artist. The dummy variable *in-depth introduction* corresponds to 1 if the lot is subject to such a paragraph. This in-depth introduction applies to 29% of our sampled cases. We speculate that the additional information and the effect of differentiation compared to other lots brought by this extra paragraph to latent bidders should lead to an increase in sale probability and price. Lastly, we generate a dummy variable *positive comment* for whether the lot description contains an additional comment such as "beautiful/wonderful piece", "high/exceptional quality", "rare piece of art" or "museum piece", the intention of which is to emphasize the quality of the good in order to boost sales rate or prices. These positive comments are written by the art expert in charge of the description of the lots. 45% of our sampled lots go with a positive comment, which can be considered as high, but can be justified by the youth of this art market which is certainly still in a process of legitimisation.

We now turn to auctioneers' tools to intervene in the ongoing sale by distinguishing four of them. First, the auctioneer (or the expert to whom he delegates the task) has the possibility to read the whole description of the lot which will proposed for sale or to read only its title before bidding starts. Reading descriptions takes time and bidders have already carefully read the information about their lots of interest before auction. It also threatens to install a routine and slow down auctions. We thus speculate that descriptions reading has a negative influence on sale probability and prices. To test for this effect, we include the dummy variable *description reading* that take the value of 1 if the lot description is read –in our sample in 66% of cases–, 0 otherwise. Sometimes, it happens that the auctioneer (or expert by proxy) corrects a mistake or mentions a feature (s)he forgot to write in the description about the lot: we create an *oral correction* dummy variable that takes the value of 1 if there is a correction (2% of our sample) and 0 otherwise, to identify a potential impact (whatever the nature of such correction, in favor or not of the item for sale). We believe that this change in the given information is not neutral within the sale process. On the one hand, an oral correction may have a positive effect on prices if it enhances trust of bidders in the auctioneer's good faith and/or because it can impair decision-making under time pressure (Ku et al. 2005, Adam et al. 2011). On the other hand, an oral correction may worry the bidders that would turn away from this lot.

Next, the auctioneer may shed light on a lot by saying some positive remark about it, such as "beautiful artwork", "unmissable opportunity" or "it's worth more". This kind of remarks reflects the quality perceived by the auctioneer – usually not an expert–, and represents

an advertising and persuasive message sent in the heat of the moment. This auctioneer's strategy aims at increasing the probability that the lot goes sold and the price. The impact of this tactic depends on the legitimacy attributed by bidders to the auctioneer's judgement. The variable *positive remark* is coded 1 if the lot is highlighted by a positive auctioneer's remark, 0 otherwise. In our sample, 19% of lots are subject to a positive statement with respect to them. Finally, we observe that auctioneers often use humor and make jokes when conducting auctions. We are not aware of any studies that have analyses the effect of humor in real auctions setting. In the management literature, humor is "*a message whose ingenuity or verbal skill or incongruity has the power to evoke laughter*" (Lee and Kleiner 2005). It is likely that humorous notes by auctioneers have no effect on auction outcomes since they do not give any information on the artwork for sale. However, if we consider the auctioneer as a salesperson, the literature has shown that humor usage by a salesperson results in increased customer trust (Bergeron and Vachon 2008, Lussier et al. 2017) which might positively contribute to auction outcomes. To capture the humor effect, we add the discrete variable *humor*, which equals to 1 if the auctioneer made one or more humoristic comments (and 0 otherwise). We find that the auctioneer employed humor for 21% of our sampled lots.

We summarize all the variables with the expected sign of their impact on auction outcomes in Table 2.

Table 2 Summary of the expected signs for the impact of each variable on auction outcomes

Variables	**Expected sign for the impact of the variable on auction outcomes**
Organisational variables	
Other sales	+ / -
Sale size	+
Lot order	-
Number lots author	+ / -
Subrank author	+ / -
Multiple items lot	+ / -
Lot top-up	+
Promotion variables	
Illustration size	+
In-depth introduction	+
Positive comment	+
Auctioneer variables	
Description reading	-
Oral correction	+ / -
Positive remark	+
Humor	no effect / +

3.4. The model

Our hypothesis is that auction house and auctioneer daily work play a role on sales, prices and the ratio final price and pre-sale mean estimate. The hedonic approach shows that price variations among heterogenous products can be explained by differences in characteristics (Court 1939, Griliches 1971) such as, for artworks, artist-related features, artwork attributes, but also, and this is our concern, sale-related aspects. We implement a hedonic price model considering variables related to the auction house and auctioneer's impact, in addition to variables linked to artists and artworks that serve as controls for heterogeneity. Our analysis consists in two regressions: we estimate an empirical model 1 that explains the (log) price buyers' premium included and a model 2 in which the observed variable is the (log) hammer price in percentage of the pre-sale average estimated price. Pre-sale estimates are usually a price range, thus the pre-sale average estimate considered is the midpoint between the low and high estimate. While model 1 fits into traditional hedonic pricing models, model 2 is an original variant, that aims at understanding if auction houses/auctioneers increase the propensity of some items to perform surprisingly well.

Besides, some items do not sell in auctions, as no bid exceeds the reserve price. Excluding unsold items is commonly chosen in studies but results in biased coefficients (Alford et al. 2017). Our sample include all lots, sold (72%) or not (28%), and we apply a Tobit model that takes into account the probability for an item to be sold in addition to the price and the spread between the hammer price and mid-estimate. As our latent variable (the selection of the item) does not assimilate to the observed dependent variables (the price and the price-estimate ratio), we use a Type II Tobit model. Formally, our model is:

$$y^*_{1,i} = o_{1,i}\beta_1 + p_{1,i}\beta_1 + a_{1,i}\beta_1 + w_{1,i}\beta_1 + \varepsilon_{1,i} \quad (1)$$

$$y^*_{2,i} = o_{2,i}\beta_2 + p_{2,i}\beta_2 + a_{2,i}\beta_2 + w_{2,i}\beta_2 + \varepsilon_{2,i} \quad (2)$$

$$y_{1,i} = \begin{cases} 1 & if\ y^*_{1,i} > 0 \\ 0 & if\ y^*_{1,i} \leq 0 \end{cases} \quad (3)$$

$$y_{2,i} = \begin{cases} y^*_{2,i} & if\ y^*_{1,i} > 0 \\ 0 & if\ y^*_{1,i} \leq 0 \end{cases} \quad (4)$$

where $i = 1, \ldots, N$ denote each lot with N the sample size, $o_{j,i} = \left(\begin{array}{ccc} o_{j,i}^{1} & \ldots & o_{j,i}^{K_j} \end{array} \right)$, $j = 1, 2$, are two vectors of observed organizational characteristics of the auctioned lot, $p_{j,i} = \left(\begin{array}{ccc} p_{j,i}^{1} & \ldots & p_{j,i}^{K_j} \end{array} \right)$, $j = 1, 2$, are two vectors of observed promotional characteristics to which the lot is subject, $a_{j,i} = \left(\begin{array}{ccc} a_{j,i}^{1} & \ldots & a_{j,i}^{K_j} \end{array} \right)$, $j = 1, 2$, are two vectors of observed characteristics related to the auctioneer interventions for the lot, $w_{j,i} = \left(\begin{array}{ccc} w_{j,i}^{1} & \ldots & w_{j,i}^{K_j} \end{array} \right)$, $j = 1, 2$, are two vectors of observed works of art characteristics (control variables), $\beta_j = \left(\begin{array}{ccc} \beta_{j,1} & \ldots & \beta_{j,K_j} \end{array} \right) \in \mathbb{R}^{K_j}$, $j = 1,2$, are two vectors of unknown coefficients. The random disturbances $\varepsilon_{j,i}$ are normally distributed with zero mean and constant variance, σ_j^2 $(j = 1,2)$. $y_{1,i}^*$ is the latent variable which is the difference between the last bid and the seller's reserve price. If it is positive, it means that the last bid exceeds the seller's reserve price, so the lot is sold, if not the latent variable is negative and the lot remains unsold. It is not possible to observe the value of the latent variable $y_{1,i}^*$ but only $y_{1,i}$: the binary variable sold/unsold. $y_{2,i}$ is the observed dependent variable (logged auction price for model 1 and logged hammer price in percentage of average estimate in model 2), only observable if $y_{1,i}^*$ is positive, *i.e.* when the lot is sold. The variables $o_{j,i}$, $p_{j,i}$, $a_{j,i}$ and $w_{j,i}$ are observed for each item, no matter if it is sold or not.

4. Results

This section presents and analyzes our results on the influence of the auction house and the auctioneer on the probability of sale and prices (Model 1) (4.1.) and on the price-estimate ratio (Model 2) (4.2.).

4.1. Impact of auction house and auctioneer on probability of sale and prices

Table 3 reports the results on the impact of auction house and auctioneer on the probability of sale (Equation 1) and on the price (Equation 2). Table 5 contains the regression statistics (Appendix 2). The sample size reduction is explained by one missing item size. Overall, our estimates do not suffer from multicollinearity problems, as no variance inflation score (VIF) exceeds 3,67 and the mean VIF-score is 1,53.

Table 3 Tobit estimations. Dependent variable: price, buyer's commission incl. (N=1100)

Variables	Equation 1 Probability of sale	Equation 2 *log* (sale price)
Organisational variables		
Other sales	-0.255 **	0.004
Sale size	0.000	0.001
Lot order (% of total number of lots)	-0.301 *	0.112
Number lots author	0.262 **	0.449 ***
Subrank author	0.003	-0.353 ***
Multiple items lot	-0.129	-0.300 **
Lot top-up	0.395 **	0.110
Presentation variables		
Illustration size	0.010	0.537 ***
In-depth introduction	0.132	1.746 ***
Positive comment	0.377 ***	0.590 ***
Auctioneer variables		
Description reading	0.320 ***	-0.145
Oral correction	0.733 *	0.169
Positive remark	0.079	-0.144
Humor	0.688 ***	0.829 ***
Control variables incl.	Yes	Yes
Constant	-0.175	5.034 ***

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

The results of Model 1 show at first glance that some organizational, promotional and auctioneer effects play a role in explaining the probability of sale and the price, which supports H1, H2 and H3, although all variables do not have a significant impact. The following sections describe and analyse the influence of the auction house organizational work (4.1.1.) and promotional work (4.2.2.) as well as of the auctioneer's interventions (4.3.3.) on auction outcomes (probability of sale and price).

4.1.1. Organization of an auction sale

The number of competing sales close in time to the date chosen by the auction house for its sale is negatively associated with the outcome of artwork transactions, while not being correlated with prices. This result suggests that buyers indulge in being more stringent about their requirements when they are being offered a broader supply. Consequently, avoiding

competition is a better strategy for auction houses than trying to benefit from a bidders' attraction effect brought by other similar sales.

However, concentrating lots of the same author in the same auction sale commands a higher sales' rate and higher price premiums, a finding for which two explanations may be submitted. Firstly, this auction house's strategy aims at attracting individuals collecting this artist, in other words increasing the number of bidders. As shown by Brannman et al. (1987), Bajari and Hortaçsu (2003) and Ching and Fu (2003) among others, the number of bidders positively contributes to prices and, according to Ong et al. (2005), to the probability of sale. We note that on the comic art market, artworks of a particular artist can be nearly absent from the market for a while, as a result of the will of the artist or the dead artist's family, or of a deliberate strategy of galleries and auction houses, then an auction sale including many works of the artist appears in this context as particularly attractive for collectors interested in this artist's work. Secondly, a phenomenon of auction fever, also called "competitive arousal" or "bidding frenzy" (Häubl and Popkowski Leszczyc 2004, Ockenfels et al. 2006, Jones 2011, Malmendier and Szeidl 2020) may be at stake, which results in overbidding. Auction fever comes from a heightened arousal, due to social facilitation, rivalry, time pressure and desire to win, among others. Social facilitation is characterized by Guerin (1986) as "*the effects on behavior caused by the presence of other persons*". The tactic employed by the auction house here produces an auction setting that gathers many experts and amateurs of the artist's work. According to Zajonc (1965), the presence of an audience of coactors results in an arousal increase and Henchy and Glass (1968) add that arousal is higher in presence of an audience considered as being expert. Moreover, Zajonc and Sales (1966), Platania and Moran (2001) find that the presence of an audience leads to emission of dominant responses rather than subordinate ones.

Concerning the subrank among items from the same artist for sale, we observe a relevant negative effect upon prices. This finding suggests that bidders do not hide their intentions in the hope of making better deals at the last lots of the artist, hence they do not hand the floor over to others before entering the game. Rather, bidders compete and focus on the first lots from the artist presented for sale in order to be assured of at least one purchase, so that when each eager bidder is satisfied, less bids are submitted and prices logically decrease. This result can also be seen in the light of the declining price anomaly. Beggs and Graddy (1997) explained the price decline throughout the sale by the fact that buyers are quickly satiated by artworks because they are either dealers buying for particular client or private buyers with finite wall space or constrained resource. Viewing the set of artworks from the same author as one sale for

which buyers interested in this author especially come, our finding can be understood as the consequence of this satiety effect.

Multiple items lots achieve, on average, lower prices than single item lots. We develop two possible explanations for this result. One reason is that bidders can be frustrated to be obliged to buy the whole lot when there are mainly interested in one piece of the multiple lot, which could lead to lower bidding. Another possible explanation, for example in the case of two boards from the same comic book sold together, is that the marginal utility for buyers of acquiring pieces of art from this artist and this comic book decreases, so that the acquisition of the first artwork of this type is worth more than the acquisition of the second one, and the second one more than the third one and so forth. This declining marginal utility leads to prices below those that would have been achieved if the lot was split. One last reason for this result is that artworks sold in a set are often artworks of a lower quality than those sold individually. The sale of a multiple items lot can be interpreted as a signal of inferior quality.

On the contrary, lots with a top-up have a higher probability of sale vis-à-vis lots without any pop-up. The extra element allows these lots to distinguish themselves from others, making them appearing as singular, which brings people not to miss the opportunity of purchasing them. Thus, it is worth mentioning this top-up in the catalogue and not separating them from the item for sale.

Lastly, our results suggest that as the sale progresses, items are less likely to sell, *i.e.* bids are less likely to reach the seller's reserve price. We also find that the size of the sale do not seem to play a relevant role in outcomes.

4.1.2. Promotional work before an auction sale

With regard to presentation of lots by pre-sale catalogues, it appears that all three variables affect very significantly (at the 1% level) and positively the price. We learn that, not merely does the presence of an illustration of the item in the catalogue matters (Agnello and Pierce 1996, D'Souza and Prentice 2002, Yao and Mela 2008), but their size also plays a role in determining auction prices.

Our results show that the insertion of an additional more detailed paragraph of information produce a positive effect on artworks prices. Three reasons can be involved. As mentioned by Cinefra et al. (2019), the first rationale lies in the manifest importance given to the lot by the auction house. Second, the art market, especially for contemporary art – and the comic art is one of them–, suffers from asymmetries of information and uncertainty about the

product quality, as neither the production costs nor some objective functions of these objects provide signals of quality, contrary to manufactured goods (Coffman 1991, Frey and Eichenberg 1995, Beckert and Rössel 2013). Descriptions of lots in pre-sale catalogues are written by experts, entrusted by the auction house with examination and in-depth research about the lots presented for sale. Thus, lots presented for sale with an excess of information are more likely to be highly valued by the market, as these additional information released by a recognized actor of the market reduce information asymmetries and increase buyer's confidence. Third, it has been argued that art appreciation requires knowledge (Bourdieu and Darbel 1991), so that this added paragraph might provide a further knowledge valued by art consumers.

Next, we observe that positive comments printed in pre-sale catalogues play a relevant role in determining the probability of sale and prices. As well, this finding can be explained by the highlighted importance of this lot and by the reduction of quality uncertainty brought by the expert's advantageous comment. A last interpretation is linked to one of the three main motivations of art buyers: the social visibility. Indeed, buying art can be a mean for consumers to stand out from the crowd ("snob effect"), to stress their wealth ("Veblen effect") and to look for peer recognition ("bandwagon effect") (Leibenstein, 1950). It is possible that buyers looking for social distinction may have a higher willingness-to-pay for goods that are publicly described as being particularly "good" art.

4.1.3. The auctioneer's oral interventions

Focusing upon the auctioneer effect now, one striking result is that auctioneer's touch of humor in auctions turns out to be a highly significant and important determinant of both the sale probability and the price. Many explanations can be drawn from the literature.

Firstly, as highlighted by Duncan (1982), Teng Fatt (2002) and Vuorela (2005), one of the substantial benefit of humor is to diffuse tension, but also anger and frustration (Lee and Kleiner 2005). In the context of auctions that can be stressful, irritating and strenuous for bidders, humor participates to diminish anxiety and hostility and create a more relaxed and serene atmosphere.

Secondly, a salesperson humor usage results in increased customer trust (Bergeron and Vachon 2008, Lussier et al. 2017) through different mechanisms. Indeed, a salesperson's appropriate sense of humor shows that (s)he has sufficient confidence to tell something funny in a stressful situation, sending a reassuring signal of being in control (Avolio et al. 1999). Then,

the use of humor demonstrates humanity which is one of the dimension of trust (Doney and Cannon 1997), allowing the auctioneer to speak to the bidders of his audience on their own level. Additionally, a sense of humor increases liking for the source (Bryant et al. 1980, Hawke and Heffernan 2006) which, by ultimately improving the relationship, is likely to help improving customer trust. As Bauer (1960) claims "*any action of a consumer will produce consequences which he cannot anticipate with anything approximating certainty, and some of which at least are likely to be unpleasant*", consumers perceive risk inherent to each of their transaction, that is why trust is important to reduce their perceived risk. Trust is also critically important in a market as uncertain as the art market regarding quality, value and authenticity of the goods traded.

Thirdly, another explanation of our finding is that humor has an attention-attracting quality, it distracts the audience and prevents from a routine (Sternthal and Craig 1973, Speck 1987, Powell and Andresen 1985, Weinberger and Campbell 1991) so that bidders are less likely to disconnect from the ongoing auctions but instead keep bidding.

Surprisingly, the outcome of sale is heavily influenced by description reading by the auctioneer. One would think that reading these descriptions normally already assimilated is a useless and costly waste of valuable time, in line with the time-revenue dilemma (Chipty et al. 2015). Description reading gives prominence to the lot and acts as a second signal that confirms what is written in the catalogue. But it may also happen that reminding each lot description tempts some bidders attending the sale to join auction bidding for lots they did not intend to initially bid for, which results in a higher number of bidders. If this conjecture holds, it would be consistent with the finding of Ong et al. (2015): the number of bidders explains the probability of a successful sale outcome.

As for auctioneer's oral corrections, they produce a feeble but positive effect on the probability of going sold/unsold. One reason of this result is that some bidders may have noticed or have doubts about an information given by the auction house in the catalogue so that correction reassures bidders about the transparency and seriousness of the expertise which enhances trust in the auctioneer. Another reason is that this new or changed information is given in the process of the auction, so that bidders should take quick decision about revising upward or not their pre-sale valuations. This time constraint imposed by the auction process might impair their valuation of the new information and results in more bidding above the seller's reserve price.

Finally, positive remarks from auctioneer over the course of the auction do not contribute to any outcomes, in contrast to positive comments written in the catalogue by auction house experts (as already highlighted in 4.1.2.). It seems that the auctioneer is not considered as an expert by bidders but rather as a salesman. Bidders may doubt the legitimacy of the auctioneer to give unbiased comments about artworks.

We can conclude that both information-based factors, *i.e.* organizational and promotional characteristics of the sale known ahead of the auction sale, and noninformation-based, *i.e.* behavioral factors induced by the auctioneer in the course of the auction, play a relevant role in determining outcomes of artwork transactions and auction prices.

4.2. Impact of auction house and auctioneer on price-estimate ratio

Table 4 reports results on the impact of auction house and auctioneer on the price differential between the hammer price and the average pre-auction estimated price (Equation 2), taking into account the possibility that an artwork might go unsold (Equation 1). Table 5 contains the regression statistics (Appendix 2). As for Model 1, the sample size reduction is due to one missing item size and multicollinearity is not a problem.

With Model 2, we investigate the mechanisms used by auction houses and auctioneers that are systematically able to influence the hammer price in percentage of the average pre-sale estimated price. This ratio measures the spread between the value attributed by the expert of the auction house and the seller (when negotiating and fixing the estimates) and the value attributed by the bidders (the final bid results from the series of bids). When positive, this spread is a pleasant surprise for sellers whose works of art sell over the mid-estimate. This positive discrepancy appears as an added value of the auction channel for sellers, compared to sales in galleries. Naturally, the higher this spread is, the greatest the seller's surprise and satisfaction become. Consequently, sellers become more likely to use the auction house's services again when surprised by higher prices, which in turn should results in increased sales and profits level for the auction house (Ekelund et al. 2013). Moreover, the auction house has an interest of getting the highest possible prices since the buyers' premium and the seller's commission are proportional to the hammer price.

Table 4 Tobit estimations. Dependent variable: hammer price in percentage of the average estimate (N=1100)

Variables	Equation 1 Probability of sale	Equation 2 log (hammer price in % of average estimate)
Organisational variables		
Other sales	-0.071	-0.044
Sale size	0.000	0.000 **
Lot order (% of total number of lots)	-0.086	-0.085 **
Number lots author	0.101	0.037
Subrank author	0.005	-0.008
Multiple items lot	-0.075	-0.015
Lot top-up	0.311 **	0.072 **
Presentation variables		
Illustration size	0.044	0.023
In-depth introduction	0.109	0.016
Positive comment	0.389 ***	0.136 ***
Auctioneer variables		
Description reading	0.185 *	0.089 ***
Oral correction	0.664 **	0.195 ***
Positive remark	0.223 **	0.015
Humor	0.764 ***	0.166 ***
Control variables	Yes	Yes
Constant	-0.396	0.214 ***

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

The two following sections distinguish between the impact of organizational and promotional work (4.2.1.) and of the auctioneer (4.2.2.) on the price-estimate ratio.

4.2.1. Organisational and promotional work by auction house

Estimations show that there are less significant organization and presentation effects on this "surprise ratio" than on prices. With respect to sale organization, lots accompanied by top-ups are more valued by bidders than sellers or auction houses, therefore producing a higher price-estimate differential than lots without top-ups. Moreover, our results provide corroboratory evidence of the declining price anomaly (Beggs and Graddy 1997) as our price relative to the average estimate decreases throughout auctions. We also find that sale size has a positive effect on the auction price relative to the pre-sale estimate. In other words, bigger sales with a lot of items to sell are more likely to generate price surprises than smaller sales. This can

be explained by the fact that smaller sale are often more prestigious sales (in our sample, Christie's sales are smaller than other sales but include relatively more high-end items), so that estimates for these lots are already relatively high. Higher estimates logically reduce the likelihood for the final price to stray from the mean estimated price.

Regarding pre-sale promotional effects on the "surprise ratio", the only factor that plays a relevant and significant role is the written positive comment effect. This finding shows that bidders are particularly sensitive and receptive to positive comments from experts coming with item description. Auction houses' experts are considered by bidders as credible when they deliver signals that aim at reducing quality uncertainty. If the social recognition motive is at stake when bidding for art acknowledged for their quality by expert positive comment, then our result shows that this motivation leads bidders to be willing to bid above the mean estimated price.

4.2.2. Auctioneer's behavior

But the most striking result of this second model is undoubtedly the clear and highly significant impact of the auctioneer behavior on this "surprise ratio". Contrary to pre-sale information, that can be anticipated a long time ahead of sale, auctioneer's interventions occur only over the course of the auction. The auctioneer is therefore better able to handle and create surprises.

Firstly, the surprise appears to be higher when the auctioneer takes the time to read the description of the lot, giving some importance to the lot. One interpretation is that reminding lot information might encourage some additional bidders to join the auction, even if they did not intend to at the beginning, thus pushing the number of bidders up. As shown by Brannman et al. (1987), Bajari and Hortaçsu (2003), Ching and Fu (2003), the number of bidders has a significant positive effect on buying prices. Another interpretation is that the auctioneer may heighten bidders' excitement and eagerness through a pending effect: bidders are reminded the full characteristics of the art they desire but still have to wait before being allowed to start competing for winning the lot. This argument supports the phenomenon of auction fever (Ku et al. 2005, Ockenfels et al. 2006, Jones 2011, Malmendier and Szeidl 2020), when excitement leads to bidders' overbidding behavior (Murnighan 2002, Häubl and Popkowski Leszczyc 2004, Ku et al. 2005, Malhotra 2010, Adam et al. 2015) that fosters the "surprise ratio" outcome. Impatience in bidder behavior has already been observed, as regard to jump bidding (Isaac et al. 2005).

Secondly, oral corrections provided by the auctioneer have a significant and positive influence upon our price-estimate ratio. In this situation, the oral correction about the lot is provided just before starting the bidding process for this lot. Bidders have to quickly process the new piece of information and take a decision about their valuation reassessment. Time pressure have different consequences on bidders behavior. Ku et al. (2005), Malhotra (2010) and Adam et al. (2015) observe that time pressure can bolster bidders' arousal, while higher arousal can result in bidders placing higher bids (Murnighan 2002, Ku et al. 2005, Malhotra 2010, Adam et al. 2015). Indeed, high level of arousal induces restriction of attentional capacity (Mano 1992), higher risk-seeking (Mano 1994) and reduces time spent for deliberation and information processing (Lewinsohn and Mano 1993). Moreover, Shiv and Fedorikhin (2002) find that when the available time for the decision is low, the role of affect in decision making is more likely to prevail over deliberative thoughts about the decision consequences. Thus, it is likely that bidders who were interested in the lot before the correction may overvalue the new information, letting themselves to be dragged about by their first desire of the item acquisition. Due to time pressure, the new information tends to be overrated compared to pre-sale and anticipated information. The surprise ratio is therefore related to the time constraint affecting bidders' information processing. Also, this new piece of information provided to bidders reduce the quality uncertainty, which can be passed on to the number of bids placed and consequently to the price-estimate ratio. Finally, as explained above, when the auctioneer provides an oral correction, (s)he demonstrates honesty and rigour qualities that foster consumer confidence, which in turn may affect the surprise-ratio through more bids placed on the lot.

Thirdly, the surprise ratio tends to higher when the auctioneer exercises a sense of humor. Thus, reducing bidders' anxiety, enhancing bidders' trust and attention through humor not only positively contributes to purchase prices but also to the outcome of seller's surprise. One can also argue that the auctioneer is selling a pleasant auction sale experience to bidders and that this enjoyable dimension of the sale is integrated to the bidder's utility function. This dimension cannot be considered *ex ante* by auction houses when setting price estimates, which explains that it plays a role in determining the surprise ratio. Adopting joking behavior is therefore a successful strategy for auctioneers.

Finally, auctioneer's positive remark through the auction process do not seem to play a relevant role in determining a higher auction price relative to the mean price estimate. One could have think that a positive remark about the lot by the auctioneer would above all give importance to the item and convince bidders about the item's quality. In fact, auctioneer's positive remarks do not affect auction prices nor the spread between average estimate and

hammer price. This result shows that bidders lend legitimacy and trust to the expert of the auction house who writes pre-sale information and lot description, but not to the auctioneer, who is rather considered as a salesperson, in charge of providing an amusing experience. The important auctioneer's effect on the surprise ratio demonstrates that the auctioneer has a real and full role to play as a salesperson during the sale and his actions and performance produce concrete and worthy results.

5. Conclusion

Although research on auctions is prolific, consequences of a third party presence, *i.e.* an auctioning agent, have been generally underinvestigated in the respective literature. Until today, few research studies have tried to address the auction houses' day-to-day work and human auctioneer effects upon auction market outcomes (Lacetera et al. 2016). In the present study, we provide an original examination of the impact of auction houses' daily work and auctioneers' way of conducting auctions on sale outcomes: the probability of sale, the final purchase price and the hammer price in percentage of the pre-sale mean estimated price. This paper differs from other studies in that we link variables deriving from pre-sale catalogues as well as from actions over the course of the auction sale with the probability of sale and price metrics. The application of a hedonic price analysis confirms the role of auction house organizational and promotional strategies (information-based factors) and auctioneer behaviors (behavioral factors) in determining outcomes of artwork transactions, prices or price-estimate ratios for otherwise equivalent art. To be specific, our empirical findings reveal that auction house should give particular attention to the organization of the sale, as many effects exert an influence upon probability of sale and prices, such as the level of competition with similar sales, the number of lots from the same artist, the presence of a top-up or the decision of selling lots including multiple items. We also find that the promotional work carried out by auction houses results in increases in artwork prices, while the presence of a written positive comment ahead of the sale seems to be decisive: it has a highly significant and positive influence upon probability of sale, prices and the surprise ratio. Finally, we show that the human auctioneer has a prominent impact on outcomes. Our results highlight first that the usage of humor by the auctioneer plays a relevant role in determining sale probability and auction prices, and second that the surprise ratio is mostly determined by the behavior of the auctioneer, whose role of salesman appears to be crucial in selling an entertaining auction experience in a climate of trust, rather than in bringing an expert point-of-view about items for sale.

This research brings a more comprehensive understanding of bidders' behavior, the mechanisms through which auction houses and auctioneers affect outcomes, and the functioning of real-world auction markets. Moreover, the findings of this study yield important managerial insights for marketers. The auction houses effects detected here reveal the economic significance of auction houses strategies and provide some guidance as to the organization of auction sales and the promotion of lots, in order to maximize revenues. Successful outcomes are more likely when auction sales are not organized at the same time as other similar sales, when the lot includes a top-up and when artworks from the same artist are gathered in one sale. On the contrary, auction houses should be aware that lots from the same artist presented last tend to reach lower prices and we recommend that multiple items lot should be split in single-item lots when possible. As for promotional factors, writing positive comments in pre-sale catalogues appears to be particularly relevant in order to enhance outcomes. Finally, we have shown clear evidence of the impact of auctioneer's actions on bidders' behaviors over the course of the auction sale, which in turn affect final outcomes. Our results suggest reasons for an auctioneer to read lots description before launching the lot bidding process, to use humor as a relational tool, while not to avoid information corrections. Our study shows the importance of the auctioneer humoristic skills in service delivery for auction houses. This observation can be used in the recruitment process of auctioneers, since having a good sense of humor increases profits for auction houses. This insight also demonstrates the usefulness of humor training programs for auctioneers. However, praising artworks during the auction does not seem to have any utility for auctioneers.

We conclude with some limitations of our study and possible future extensions. First, our data do not include individual bidders' characteristics. Such data would allow to link auction houses' and auctioneers' strategies with individual bidders' behaviors and better assess the role of bidders' heterogeneity in their responses to auction house and auctioneer tactics. Then, other variables related to the sale organization and the promotion of lots are worth being examined, such as the layout, the venue and the duration of the exhibitions organized by the auction house before the sale. With respect to the auctioneer behavior, our variables concentrate on oral interventions. Exploring the impact of auctioneer's gesture and bodily conduct on auction outcomes is also a promising avenue. Furthermore, results presented in this study only focus on the European comic art market, answering to the requirement of studying a homogeneous market in order to isolate auctioning agent effects ; future research using data from other auction markets is necessary to explore auction house and auctioneer effects more broadly. Examining to what extent our results can be extended to other markets would be

particularly interesting. We consider ascending (English) auctions in this paper, but other auction systems including an auctioneer are worth further empirical research.

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Appendix

Appendix 1

To control for the heterogeneous character of artworks, we include the more commonly used hedonic variables for studies on the art market and we add a key characteristic of the comic art market related to the presence of the hero. Appendix 1 presents the control variables and their definitions.

Variable	Definition
artist's reputation	*Artist's reputation* is measured by the number of words in the artist biography found on Bédéthèque website.
artist's recognition	*Artist's recognition* is a dummy variable equaling one if the artist has been honoured by an award for her/his career (Grand Prix de la ville d'Angoulême, Will Eisner Comic Industry Awards or the Harvey Awards), 0 otherwise.
successor artist	*Successor artist* is a dummy variable equaling 1 if the work has been created by a studio or a follower artist, 0 otherwise.
living status	*Living status* is a dummy variable coded 1 if the artist is dead when the artwork is sold, 0 otherwise.
signature	*Signature* is a dummy variable which equals to 1 if the artwork is signed, 0 if not.
condition	*Condition* is a dummy variable which takes the value of 1 if the work is damaged, 0 if not.
board	*Board* is a dummy variable equaling one if the artwork is a board or a strip (which is a part of a board), 0 otherwise.
illustration	*Illustration* is a dummy variable equaling one if the artwork is an illustration, 0 otherwise.
coverpage	*Coverpage* is a dummy variable equaling one if the artwork is a coverpage, 0 otherwise.
draft	*Draft* is a dummy variable equaling one if the artwork is a draft, 0 otherwise.
coloring	*Coloring* is a dummy variable equaling one if the artwork is a coloring (the colored separate support when colors are dissociated from the drawing strokes), 0 otherwise.

ink	*Ink* is a dummy variable equaling one if one of the medium used for the artwork is ink, 0 otherwise.
paint	*Paint* is a dummy variable equaling one if one of the medium used for the artwork is paint, 0 otherwise.
pencil	*Pencil* is a dummy variable equaling one if one of the medium used for the artwork is pencil, 0 otherwise.
feltpen	*Feltpen* is a dummy variable equaling one if one of the medium used for the artwork is feltpen, 0 otherwise.
pasting/mixed medium	*Pasting/mixedmedium* is a dummy variable equaling one if one of the medium used for the artwork is pasting or mixed medium, 0 otherwise.
action	*Action* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to action, 0 otherwise.
ads	*Ads* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to advertisement, 0 otherwise.
adventure/suspense	*Adventure/suspense* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to adventure or suspense, 0 otherwise.
archetypes	*Archetypes* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to archetypes, 0 otherwise.
arts	*Arts* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to the arts, 0 otherwise.
death	*Death* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to death, 0 otherwise.
erotism	*Erotism* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to erotism, 0 otherwise.
fantasy/magic	*Fantasy/magic* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to fantasy or magic, 0 otherwise.
genre	*Genre* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to genre scenes, 0 otherwise.
historical context	*Historical context* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to historical context, 0 otherwise.
homage	*Homage* is a dummy variable equaling one if one of the subject matter depicted in the artwork is an homage, 0 otherwise.

humor	*Humor* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to humor, 0 otherwise.
interaction	*Interaction* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to interaction, 0 otherwise.
landscape	*Landscape* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to landscape, 0 otherwise.
love	*Love* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to love, 0 otherwise.
portrait	*Portrait* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to portrait, 0 otherwise.
science-fiction/high-tech	*Science-fiction/high-tech* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to science fiction or high technologies, 0 otherwise.
war/violence	*War/Violence* is a dummy variable equaling one if one of the subject matter depicted in the artwork refers to war or violence, 0 otherwise.
number of famous heroes	*Number of famous heroes* is the number of times the hero(es) is/are displayed in the artwork weighted by the Amazon ranking of the album from which they originate.

Appendix 2

Table 5

Regression statistics

	Model 1	**Model 2**
Number of Observations	1100	1100
Missing Values	1	1
Number of endogeneous variables	2	2
Censored observations	308	308
Censored observations (%)	0.28	0.28
Log Likelihood	-1595	-418.31
Optimization Method	Quasi-Newton	Quasi-Newton
AIC	3387	1033
Schwarz Criterion	3877	1523

Chapter 4 :

The three stages of an auction: how do the bid dynamics influence auction prices? Evidence from live art auctions[1]

Abstract:

This research examines whether and how the bid dynamics influence the final price, using a unique hand-collected database gathering bid dynamics of artworks auctioned live by a human auctioneer. Specifically, we study the degree of aggressiveness of bids and the pace of the auction resulting from the succession of bids, at the three main stages of an auction. We first find that bid dynamics are not neutral towards final auction prices. In line with our theoretical framework, this result confirms the importance of bidders' "fuzzy" reserve prices which explains why bidders adopt strategic behaviors. We then find that the auction price particularly benefits from the presence of "motivated" bidders, *i.e.* bidders who bid aggressively (high and quickly) to win the auction and do not seek for a bargain, especially at the beginning and end of the auction. At the end however, this positive impact of aggressive bidding may be attenuated by a despondency effect affecting some bidders. Moreover, we find that early arousal, which also contribute to provide valuable information on the artwork's common value, boost the price. Lastly, we show that ultimate duels between bidders increase final prices. Overall, this paper proposes a primer conceptual framework of bidders' fuzzy reserves. This investigation contributes to the understanding of bidding behaviors by offering an easily understandable insight into bid dynamics, and by analyzing the case of live-auctions of hedonic products that has received few attention until now.

Keywords: *bid dynamics, auction price, fuzzy reserve prices, auction phases, live auctions, art market*

[1] This chapter is written with Régis Blazy.

1. Introduction

Auctions, although an ancient mode of exchange, have gained an increasing public attention these last two decades, especially due to the emergence of Internet auctions in the 1990s. They now account for a significant volume of economic activity and have become a mainstream form of trading. Auction markets have been the subject of a large body of academic research. This literature has mainly focused on how the different kinds of auction designs (e.g. English, Dutch, first-price and second-price sealed-bid auctions) affect revenues and efficiency. Factors such as differences in risk preferences, affiliation, information asymmetries or collusion have been explored in this research (see Klemperer 1999 for a review). The outbreak of online auctions has offered new research opportunities thanks to the huge amount of freely available field data. This stream of research has provided valuable insights into human bidding behaviour. Classical auction theory assumes bidder rationality, in other words that bidders enter an auction with a fixed valuation for the auctioned items defined ahead of auction, so that the final outcome of the auctions – the price – is determined by ex-ante calculations of bidders. However, empirical studies have provided significant evidence suggesting that bidding cannot be reduced to a maximization of expected utility, but rather that the dynamics of bidding behaviour matters.

Indeed, while an auction has been launched and is in progress, auction participants may be influenced by a number of value signals, such as the minimum bid and other participants' bids. Studies have shown that the opening bid (*i.e.* sellers are required to set a starting bid for their items) has a significant impact on the final auction price. Bajari and Hortacsu (2003), Häubl and Popkowski Leszczyc (2003), Lucking-Reiley et al. (2007) and Hou (2007) among others found a significant positive effect, explained as the result of the informative quality signal sent by the opening bid for items which are hard to estimate, whereas Ku et al. (2005, 2006) found a negative impact, due according to the authors to the attractive power of low starting bid that leads to bidding wars which can push up prices. Regarding other participants' bids, Dholakia and Soltysinski (2001), Dholakia et al. (2002) and Simonsohn and Ariely (2008) have shown that bidders herd into online auctions with more existing bids, ignoring comparable or even more attractive available auction item.

Moreover, researchers have pointed out that bidding involves emotional aspects and observe an auction fever phenomenon especially in ascending auctions (Ku et al. 2005, Jones 2011, Adam et al. 2011, Adam et al. 2015), described as "*an emotional state elicited in the course of one or more auctions that causes a bidder to deviate from an initially chosen bidding strategy*" (Adam et al. 2011, p. 204). Ku et al. (2005) explain that auction fever may stem from

both bidder's escalation of commitment (*i.e.* individuals seek to view themselves positively which leads them to avoid giving up or admitting a mistake, so that they can continue bidding even when they have outreached their limits to fulfil the need to self-justify their previous bids) and bidder's competitive arousal (*i.e.* numerous factors can increase arousal, which in turn impairs decision-making, such as rivalry, the presence of an audience, time pressure and the uniqueness of being first). They found that Internet bidders who have exceeded their limits have spent more time in auctions than the ones who have not exceeded their limits, that bidders exceed their limits more in the later stages of auctions, more when few other bidders remain, and by greater amounts in live, *i.e.* in the presence of an audience, than in Internet auctions.

Time seems to also play an important role in determining bidding in dynamic auctions. In descending auctions, Katok and Kwasnica (2008) found that under time pressure, bidders place lower bids, whereas in ascending auctions, Ku et al. (2008) observe particularly high bids when bidders are confronted with high time pressure and high stakes, a result corroborated by Cheema et al. (2012). Roth and Ockenfels (2002) observe that a large part of bids is placed within the last minutes in hard-close online auctions (eBay©), a phenomenon called "sniping" that has been highlighted by many other studies (Bajari and Hortaçsu 2003, Ockenfels and Roth 2006, Borle et al. 2006, Cao et al. 2019, among others), which shows that a modification of the auction system such as the time limit affects bidding behavior. Houser and Wooders (2005), Glover and Raviv (2012) and Gray and Reiley (2013) find evidence of lower prices in sniped auctions. Besides, Haruvy and Popkowski Leszczyc (2010) find that short auctions result in higher prices compared to auctions with a longer duration, due to more jump bidding. Jump bidding, a well-established phenomenon in ascending auctions, consists of placing a bid larger than the minimum bidding increment required to be a winning bidder, which can be a result of impatience, strategic concerns, or can serve as a valuation signal as well as to signal an aggressive strategy. The literature have shown that the bid increment and the rules of bidding (allowing jump bidding or not) can have effects on the revenues of an auction (Isaac et al. 2005, Isaac et al. 2007) and that the choice of bids allow the bidders to communicate within the competitive structure of English auctions (Avery 1998, Easley and Tenorio 2004, Kwasnica and Katok 2007).

These studies all highlight the fact that the dynamics of bidding behaviour are far from being irrelevant, however they focus on summary statistics of the auction such as the number of bids, the percent of bids placed in the last minutes of an auction or the duration of an auction.

Other studies have sought to investigate further into the bid dynamics, *i.e.* the distribution of bids over the course of an item auction. A first stream of research has introduced

advanced data visualisation of sequence of bids. Shmueli and Jank (2005) and Hyde et al. (2006) propose different visualisation methods and tools for bid histories, including complex types of visualisations for viewing bid data of concurrent auctions (on auction sites such as eBay©, many identical products are sold in simultaneous auctions, therefore being dependent and concurrent auctions). Shmueli et al. (2006) offer a tool for interactive visualisation of bidding data, which allows an interactive exploration of datasets with bid histories (time series) as well as auction attributes (cross-sectional data).

Another stream of literature consists of modelling bidding dynamics. Shmueli et al. (2007) elaborate a probabilistic model for the bid arrival process in online ascending auctions. Park and Bradlow (2005) have developed a dynamic model of bidding behavior in Internet single-item ascending auctions that addresses whether people will bid, who will bid, when they will bid, and how much they will bid for the entire sequence of bids on an auction item. Bradlow and Park (2007) explore how bidders' behaviors evolve over the course of an ascending auction by modelling auction data drawing upon the record-breaking literature in statistics with Bayesian data augmentation methods. Reddy and Dass (2006) have modelled online ascending art auction dynamics (107 lots) using functional data analysis in order to investigate the effect of different characteristics (related to the auction house/seller, the level of competition, the artist and the artwork) on bids movement during the entire auction. They find that the influence of these factors on the current bid level and on the velocity (rate of change in bids) vary over the duration of the auction, some being stronger or inexistant at various stages of the auction process (at the beginning of the auction, at the middle or at the end). Bapna et al. (2008) also use functional data modelling to explore the dynamics (price evolution and its first and second derivates meaning price speed and acceleration respectively) of the price formation process of online auctions on eBay©, investigating five kinds of explanatory factors of bid dynamics at various moments of an item auction. Wang et al. (2008) create a dynamic forecasting model for bids in online ascending auctions, based on functional data analysis, which operates during the live auction and forecasts bids not only at the auction end but also at a future time point of the ongoing auction. Jap and Naik (2008) provide models to predict bidding dynamics within business-to-business online reverse auction. Lastly, Ceyhan et al. (2011) model in the case of online peer-to-peer (P2P) lending services how the bid trajectories predict loan outcomes (*i.e.* loan funded vs. not funded, and loan paid back vs. not paid back). It turns out from these studies that the trajectories of bids say something about the auction outcome.

The focus of this paper is on traditional auctions, *i.e.* ascending auctions conducted on-site in the art market, for which we investigate if and how the degree of aggressiveness of bids

and the pace of the sequence of bids (*i.e.* acceleration and deceleration phases) can predict the final outcome of the auction, that is the price. The sequence of bids refers to the entire series of bids placed by bidders over the duration of an item auction. Thus, this study examines how the pricing outcome is affected by the micro bid level at traditional auctions.

On-site outcry auctions differ from online auctions. First, traditional auctions occur in a close time frame, as each lot is auctioned within a few tens of seconds or in a matter of minutes (60 seconds is the time typically taken to sell a lot) whereas online auctions are opened for bidding over an extended time period, generally over several days. Second, bidders in live auctions tend to be more committed since they make themselves available for the exact moment and duration of the item auction they are interested in and can spend time to commute to auction house building, than online bidders who make less effort as they can bid from wherever and choose when they want to bid over the longer auction duration. Third, on-site auctions involve different ways of bidding, depending on the rules of the auction house: placing bids physically from the room, by purchase order addressed to the auction house in advance (the auctioneer is in charge of placing bids on the behalf of the person who left a purchase order), by phone, or on the Internet if the auction is broadcast live. Fourth, compared to online auction, on-site auctions involve the presence of a human auctioneer who conducts the auction and has an undeniable role of salesman to enhance bidding by increasing bidders' engagement and excitement with what is called the auctioneer's "chant" (Chipty et al. 2015, Lacetera et al. 2016). However, previous bid dynamics studies have largely relied on online auction. One reason of the paucity of research on on-site auctions is the challenge of obtaining accurate data on the timing and amount of all bids placed over the course of the item auction. Thus, there is a need for field studies to analyse bidding dynamics in on-site auctions in order to understand how the sequence of bids, which reflects bidders' and auctioneer's strategies specific to the on-site context, influence the price.

Moreover, we focus on the art market where the goods exchanged are hedonic and unique ones, whereas previous research on bidding dynamics on the Internet have explored markets of utilitarian or functional products, with the notable exception being the work of Reddy and Dass (2006). Yet, purchase of hedonic products such as art is steered by motivations which are completely different from those of functional product purchase, namely aesthetic pleasure, social status and financial investment. This contrast in motivations may result in different commitment levels of bidders. In addition, as art is an emotional asset, artworks involve both common and private value components for bidders, in contrast to utilitarian goods with an objective common value. This difference may also lead to different bidding behaviours.

The lack of bidding dynamics research on hedonic heterogeneous commodities is certainly due to the complexity of modelling bidding dynamics while controlling for the high variability between goods, each artwork being unique.

Considering the bidding dynamics of traditional auctions and of hedonic products such as art thus represents an improvement over previous studies. Our question of interest is whether the degree of aggressiveness of bids and the rhythm of the sequence of bids in an ascending on-site auction appear to be neutral regarding the final price, or if instead they actively predict the final outcome. We assume that if bid dynamics have an impact on prices, it is due to the fact that bidders' reserves (the highest price they are willing to pay for an item) are "fuzzy", *i.e.* reserves of bidders change during the lifetime of the auction. To answer our question, we analyse the curve of the sequence of bids from the starting bid to the final bid, the latter being the price paid by the winning bidder for the good (to which fees may be added). However, the online auction literature (Ariely and Simonson 2003, Chiang and Kung 2005, Shmueli and Jank 2005, Hyde et al. 2006) shows that bidding patterns depend on the phase of an item auction and scholars distinguish three main phases (*i.e.* moments) of an item auction: the beginning, the middle and the end of the auction. Indeed, bidders' strategies may vary depending on the auction stage, due to several contextual changes. We therefore construct indexes capturing the bid dynamics at each phase of the auction. We measure the degree of aggressiveness of bids as well as the pace of the auction resulting from the accumulation of bids for the three phases, in order to analyse their impact on the final price.

The fact that traditional art auction houses now permit bidders to join the auction online, broadcasting live the sale, has allowed us to record these sales and to manually collect data about the opening bid, the closing price, the bid arrival time and the amount of each bid, be it in the room, on phone, on purchase order, or on Internet. We note that we lack bidding information for confidentiality reasons such as the provenance of the bid placed, the number of bidders, bidders and sellers characteristics, which excludes any analysis of individual bidding behavior for this paper. We use a rich and hand-collected database of ascending auctions conducted on-site in the art market. Our dataset comprises 547 European comic artworks auctioned between March 2017 and May 2018 by six different auction houses. Our data include bid trajectories, final prices, sale characteristics, artist characteristics and artwork characteristics.

We confirm the existence of strategic behaviors over the course of the auction whose impact is not neutral on the outcome of the auction. In line with our theoretical framework, this result supports the significance of fuzzy reserves that give bidders reasons to bid aggressively

or mildly. Regarding the aggressiveness of bids, we find that aggressive bidding has a significant and positive influence on the final price at each stage of the auction, but to a greater extent at the beginning of the auction. This is due to the presence of highly motivated bidders, who aim at winning the auction rather than preserving their surplus. At the end of the auction, this effect is slightly attenuated, as final duels seem to give rise to some despondency amongst bidders. As for the auction pace, we find that initial arousals which contribute to give information on the common value of the item substantially and positively affect the auction outcome. Moreover, acceleration of bids at the end, implying ultimate duels of bidders eager to win the auction, increases the final price. Our results confirm the prevalence of some effects (such as "motivation", "arousal" and "common value" effects) compared to others (such as "despondency" or "inclusive" effects).

The contribution of this paper is twofold. First, we bring to the literature a conceptual framework toward fuzzy reserves of bidders and their consequences. Second, we contribute to the body of literature on bidding dynamics by using indexes for the main moments of an auction that offer an easily understandable insight into the bid dynamics and their impact. We also provide a bid dynamics analysis of live auctions in brick-and-mortar auction houses with a human auctioneer, as well as of auctions of hedonic goods, which have been little explored so far.

The remainder of the paper proceeds as follows. Section 2 describes the hypotheses. Section 3 details the bid dynamics indexes. Section 4 presents the data and the methodology. Section 5 presents the results and robustness checks. Section 6 concludes.

2. Hypotheses

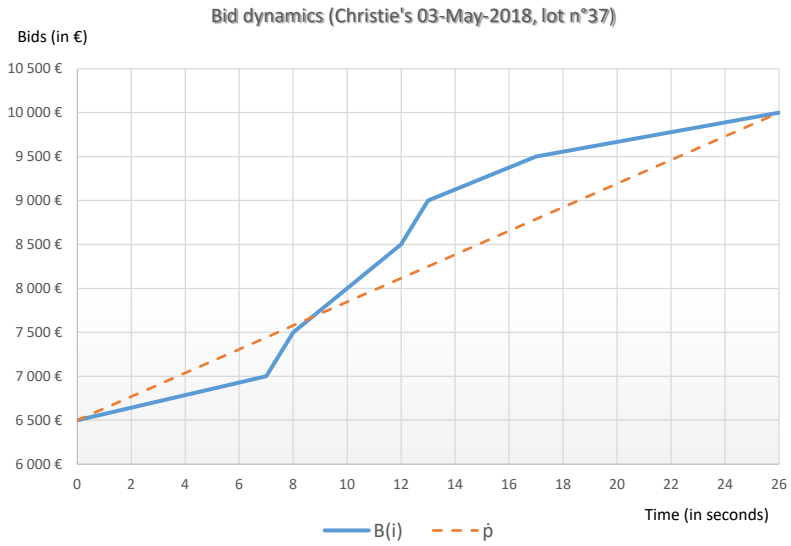
English auctions can be viewed as a succession of ascending offers that appear at various dates. In such context, if the bidders were mere "robots" (*i.e.* following no specific strategy), the bids would increase linearly. Potential buyers would bid on regular time intervals, and the value of their bid would equal the next marginal bidding step, as proposed by the auctioneer. For instance, one may figure bidders raising their hand while the auctioneer proposes prices that correspond to the next increment: some hands would go down each time the price goes beyond some bidders' individual reserve (*i.e.* the highest price (s)he is ready to pay for the lot). In such situation, relating every bidding time with the corresponding bid would lead to a linear increase in offers until they ultimately reach the hammer price (*i.e.* the final auction price for which only one hand is left raised). We consider such situation as a benchmark: here, auctions

are said “neutral” in the sense that they gather non-strategic bidders whose presence leads to a linear auction path (*i.e.* the curve linking all bids, in the plan that relates bid times to prices).

Our dataset however contradicts such prediction, as many lots for sale display non-linear auction paths (our descriptive statistics shown afterwards confirms this observation). Figure 1 illustrates this for a comic artwork (lot n°37) sold at Christie’s, the 3rd of May 2018. This lot, introduced at 6 500€, reaches its final price (10 000€) 26 seconds later. The bold curve shows the actual evolution of bids across time, while the dashed line refers to the linear benchmark for this sale. Clearly, the bids evolve in a non-linear way, showing a S-shaped curve. During its initial stage, the sale is behind time (when compared to the benchmark), then accelerates, and slows down before the auction ends. We suspect such acceleration/slowing-down phases to stem from bidding strategies that evolve throughout the auction. As suggested later on, such strategies can have some influence on the final auction price.

FIGURE 1

Example of bid dynamics (Christie’s, 03-May-2018, lot n°37)



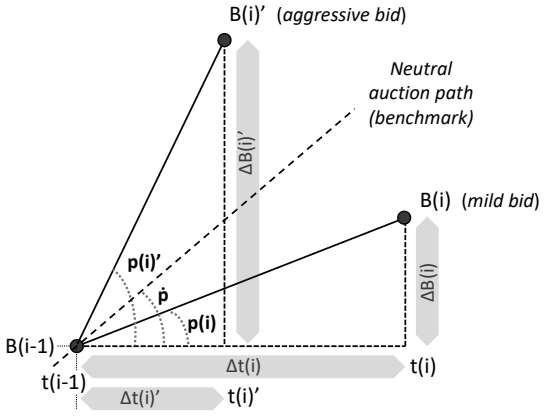
2.1. Individual bidding strategies

Let us consider a succession of N increasing bids, each indexed by i ∈ [1;N]. Every bidder (k) can bid several times during the auction without limitation. B(i) is the (i)th bid made at time t(i), in response to the (i-1)th previous competing bid, B(i-1) at time t(i-1). We denote as ΔB(i) the price increase between both offers (*i.e.* ΔB(i) is the difference B(i) - B(i-1)). Δt(i) is the time (in seconds) between both bids (*i.e.* Δt(i) equals t(i) - t(i-1)). We define p(i) as the ratio

$\Delta B(i)/\Delta t(i)$, which measures the "aggressive power" of the i^{th} bid: the higher it is, the more forceful is the bid (*i.e.* the bidding step is boosted in a period of time). An aggressive[2] (respectively mild) bid means that p(i) exceeds (resp. is less than) the benchmark slope (ṗ) of the "neutral auction path", as defined before. Figure 2 illustrates this theoretical framework. The dashed line represents the benchmark slope (ṗ). A mild bidding strategy extends the bidding time while the price increases moderately. On the figure, this leads to a small slope p(i). At the opposite, an aggressive strategy boosts the slope (that raises from p(i) to p(i)'): such bid is aggressive in that sense that it reduces the bidding time while producing a price jump.

FIGURE 2

Aggressive *vs.* mild bidding strategies



The level of aggressiveness is a strategic choice made by every candidate buyer when deciding to (re)bid. We next explore the rationale explaining why (s)he may choose a high or a low p(i) when (re)bidding on a lot.

2.2. Fuzzy reserves

The rationale behind aggressive *vs.* mild bidding strategies lies on a core assumption on the bidders' reserves which we consider as "fuzzy reserves". Indeed, as explained by Cramton (1998), D'Souza and Prentice (2002), Heyman et al. (2004) and Hou (2007), bidders may not fully respect their initial reserve throughout the auction. Following this avenue, it seems realistic to expect the bidders' maximum reserves to increase (more or less notably, depending

[2] An "aggressive bid", as defined here, differs from a "jump bid", although both notions are close. Namely, in English auctions, a jump bid corresponds to an offer that exceeds the minimal amount allowed by the auctioneer.

on each bidder's individual profile) while the auction is going on. Several reasons can explain such behavior. First, individuals can face difficulty in assessing the value of an item for sale, especially for common value goods or particular objects (D'Souza and Prentice 2002, Ku et al. 2005). This is particularly true for art objects, as art goods hold a common value component (for resale) and bidders can have imperfect information about the objects, which are unique. Thus, other bids may reveal information about the common value of the good and its quality. Some bidders interpret previous high offers as signs of stronger interest towards the lot (and may therefore readjust their valuation). Second, participating in an auction may be considered as a competitive game by bidders and, as a result, bidders may feel a strong desire to beat their rivals and win. This phenomenon, called the "uniqueness of being first" and highlighted by Ku et al. (2005), Malhotra et al. (2008) and Adam et al. (2015), can generate emotional arousal which then impair decision-making and may thus lead to overbidding. Third, in the context of an artwork sale, the uniqueness of the lots at sale makes them one-of-a-kind opportunities. While the auction goes on and gets closer to the end, the feeling that "when it's gone, it's gone" may increase the perceived value for bidders wishing to avoid after-sale regrets. Indeed, auction participants may anticipate how they will feel about losing the item after the auction, what Ariely and Simonson (2003) call the "loser's curse". Fourth, having more time to think during the auction gives the bidders the opportunity to reallocate some other purchases plans (e.g. other auctioned lots, and/or alternative scheduled expenses) to increase their chances of winning the auction. Such recalculation requires time while readjusting a budget and/or planned purchases. Of course, pure rational players should have made such computation prior to the auction. From that view, last-minute increases of reserve limits may be the sign of behavioral bias among the bidders who may adopt some myopic strategies, while bidding on a lot. Overall, fuzzy bidders can elevate (more or less, depending on individual profiles) their initial reserve during the auction: *i)* the longer it takes to sell the lot, and/or *ii)* the higher the previous offers, the more likely fuzzy reserves will subsequently increase. Of course, this process goes on up to a certain point, until they reach their hard budget constraint, which cannot expand further.

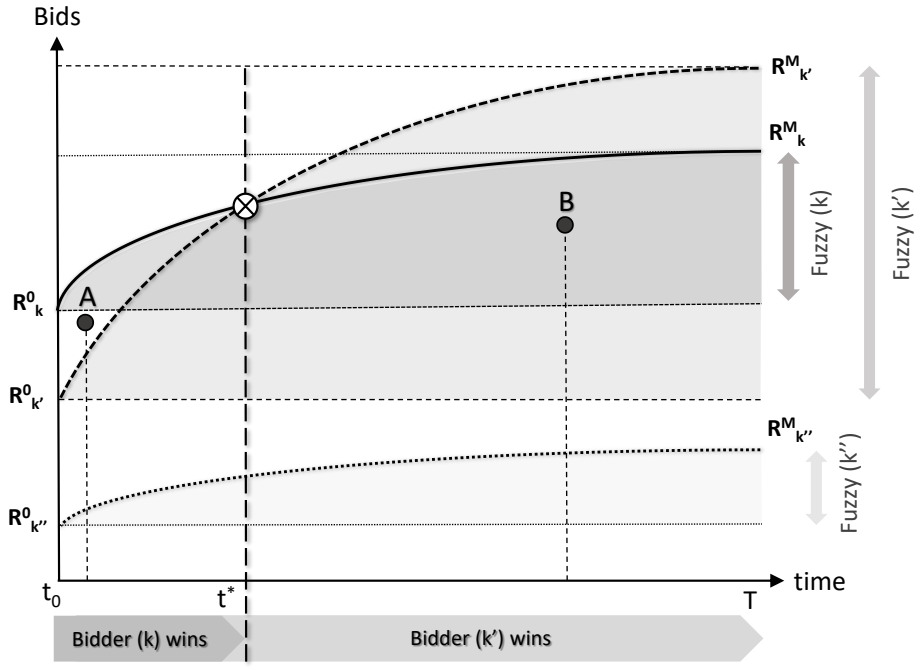
Figure 3 illustrates fuzzy reserves when three bidders (k, k', k'') compete. Suppose, for instance, that all bidders increase their fuzzy reserves in a concave way.[3] When the auction begins (at time t_0), the reserve of bidder (k) equals R^0_k; which is higher than $R^0_{k'}$ and $R^0_{k''}$, the reserves of the opponents (k' and k''). While the auction is going on, bidder (k) can always outbid (k''), but the situation gets more complicated regarding (k'). Indeed, bidder (k') is

[3] This assumption is for illustration purpose only. The same reasoning can extend to more complex evolutions.

fuzzier than (k) (*i.e.* his/her reserve increases in a larger proportion during the sale). Under this case, the initial situation may reverse during the auction. From time t^*, bidder (k') values more the lot than (k), so that his/her reserve is now higher. At the end of the auction, the reserves of (k) and (k') equal respectively R^M_k and $R^M_{k'}$, where the latter exceeds the former. During the auction, bidder (k) has a chance to win the lot until time (t^*) (point "A" reflects such situation: in "A", (k)'s offer still exceeds his/her opponent's reserve). After this time limit, the situation reverses as any future attempt can be outbid by (k') (see point "B" for example). Obviously, fuzzy reserve curves are private information (one may even consider that fuzzy bidders discover the evolution of their own reserve as the auction progresses). In that context, (t^*) can be assessed only, but never discovered. To sum it up, the longer it takes to bid, the higher is everyone's own reserve, but with a rising risk that opponents increase their reserves even more.

FIGURE 3

Fuzzy reserves (three bidders, k, k', k'')



Under the "fuzzy reserves" assumption, playing a high bid in a short time-frame (*i.e.* raising p(i)) increases the chances to kill competition, as such strategy prevents the other (fuzzy) bidders to have enough time to update their own reserves to a higher level. A bidder can play such strategy all the more easily than (s)he is far from his/her own reserve, *i.e.* (s)he still has strong dissuasive power, which might disappear while the auction is going on. Obviously, this strategy has two major drawbacks. Firstly, whereas boosting the current bid increases the

chances of winning the auction, the resulting increase of p(i) undermines eventually the bidder's individual surplus (*i.e.* the difference between his/her own reserve and the final auction price). Secondly, when the high level of p(i) stems from a fast bid, the bidder prevents him-/herself to heighten his/her own (fuzzy) reserve as (s)he shortens time for reflection. Overall, a bidder must arbitrate between two extreme strategies. On the one hand, (s)he can choose a mild-bidding strategy (*i.e.* low p(i)) that preserves his/her surplus but at the risk of giving more time to the competitors to also increase their fuzzy reserves.[4] On the other hand, (s)he can opt for an aggressive-bidding strategy (*i.e.* high p(i)) that reduces competition, thus leading to higher chances of winning the auction, but at the cost of lower individual surplus.

Depending on the number and timing of aggressive/mild bidding strategies, the auction may deviate from its neutral path (*i.e.* linear increase of bids). Such accelerations/slowdowns might generate delays/advances within the auction dynamics. We expect such strategies to have various consequences depending on the time when they take place.

2.3. Changing context with the auction stages

The impact of bidding strategies changes significantly with the stage of the auction, either at its beginning or at its end. We now discuss these contextual changes, separating the beginning and end phases of an auction (with the midpoint considered an intermediate case).

When the auction starts, the number of potential bidders is at its highest. However, this does not mean that competition is the toughest. Indeed, two factors counterbalance the level of competition stemming from numerous bidders (if any). First, the proportion of potential buyers with small or moderate initial reserves (reflecting their low interest and/or limited budget) is *ceteris paribus* higher. For the most motivated bidders, such competitors are rather easy to discourage (although their identity remains private information). Second, everyone's fuzzy reserves have not increased yet. Another consequence of a high number of bidders is that strategic interactions are relatively low at the beginning of the auction (bidders become interactive Nash-players when they are fewer). A consequence is that the bids of one potential buyer are less of a signal to others: at that point, bidders reveal less information by choosing a certain level of p(i) because they are (to some extent) drowned in the mass. Furthermore, the early stage of the auction is a moment when everyone's *ex-ante* bidding latitude is at its highest.

[4] Following such strategy also increases the risk that a rushing auctioneer ends the auction rapidly, thus bypassing bidders who are too slow to react.

Indeed, the upset price is low in ascending auctions (*i.e.* such upset price is far from the bidders' initial reserve).[5] Last, the level of information on actual competition is low when the auction starts, as few bidders have started bidding, thus showing some interest about the auctioned lot.

It might seem confusing to mention the "end of an auction" whereas there is no *ex-ante* time limitation to English auctions. That said, from an *ex-post* perspective (*i.e.* once the auction is over), analyzing the ending dynamics of a (closed) auction is a straightforward task. From that view, the context of the sale reverses and important features arise when an auction ends. On the one hand, the remaining bidders (with the highest reserves) are the toughest ones. When being fuzzy, their reserves have even had enough time to increase up to that moment. On the other hand, the bidders' ability to keep increasing their bids narrows while the competing offers get closer to their own (updated) reserve. This is even truer when their (hard) budget constraint cannot expand anymore (no matter the time given for this). Furthermore, the number of remaining bidders is lower when the auction ends.[6] As strategic interactions are stronger with fewer bidders, one can expect Nash-strategies to be more prevalent at this time. Namely, the last bidders make conjectures on the strategies of their opponents, and decide, for each conjecture, their best answer. In such context, each p(i) ratio becomes a signal likely to change the players' beliefs. Last, the level of information is higher when the auction ends, as every bidder has been observing the (aggressive/mild) strategies of their competitors, especially the latest ones.

Now that we have analyzed the buyers' bidding strategies under the changing context of an auction, we question how such strategies may alter the final price.

2.4. Tested hypotheses

In that section, we first analyze the influence of an acceleration of bids due to punctual aggressive strategies (*i.e.* p(i) increases) (section 2.4.1). Then, we wonder to which extent the price may also depend on an accumulation of aggressive/mild offers, thus generating advances/delays, and catch-up/slowing down effect in the pace of the auction (section 2.4.2).

[5] This is not always verified *ex-post*, as fuzzy reserves can increase later on, throughout the auction.
[6] However, late bidders may join the ongoing auction too. Besides, some bidders may hide during the previous stages of the auction.

2.4.1. Influence of punctual aggressive bids on the price

We discuss here the expected influence of punctual aggressive bids on the final auction price, *i.e.* how an increase of p(i) (observed at time t(i)) can alter the ultimate bid B(N), *i.e.* the hammer price observed at time t(N).[7] The bid dynamics locally accelerate (respectively slow down) when the mentioned slope increases (resp. decreases). As the bidding context changes throughout the auction, we distinguish hereafter two polar moments: the start and the end of the auction.

A. Early stage of an auction

When an auction starts, the relatively high number of potential buyers requires focusing on the most dominant strategy among them.

Choosing a high p(i) reflects an aggressive bidding strategy, which characterizes high motivation towards the lot, as it maximizes a bidder's chances to win the auction before the competitors' fuzzy reserves start rising. Obviously, the bidders who follow such strategy do not aim to drive a bargain (as they voluntary reduce the gap between their bid and their reserve), but rather to discourage competitors before they become dangerous. Choosing a high p(i) has an immediate consequence (compared to neutral bidding): by minimizing their surplus, aggressive bidders maximize their chances to win the auction, which, as a result, boosts the hammer price.[8] This leads to our first hypothesis (H1a).

> **H1a.** *[Motivation] When an auction starts, aggressive bids may boost the final auction price, i.e. a rise of p(i) may have a positive influence on B(N). Such effect reflects early "motivation" from bidders.*

A second immediate consequence appears however: if aggressive bidding is successful, a significant number of competitors can be discouraged rapidly, at the early stage of the auction. Here, fewer bidders are given the chance to stay further in the competition, and will not participate to the future growth of fuzzy reserves, if any (higher values of p(i) also reduce the auction time, which gives the early-discouraged bidders even fewer opportunities to readjust

[7] We make the implicit assumption that the ultimate bid is high enough to sell the lot. In other words, there is not selling reserve.

[8] Thus taking the risk of paying more than the second highest bid in case of opponents whose reserve would have never exceeded the bidder's one. In such (uncertain) situation, following the neutral auction path would have led the bidder to win the lot anyway, while paying the second highest bid.

their reserves afterwards).[9] In a nutshell, the level of competition is expected to decrease when the rise of p(i) is high enough to discourage bidders, especially those entering an auction with low initial reserves. As a result, less competition between potential buyers leads to a lower hammer price: the more bidders being discouraged, the stronger is the effect. This brings (H1b), as an alternative to (H1a).

> **H1b.** *[Despondency] When an auction starts, aggressive bids may undermine the final auction price, i.e. a rise of p(i) may exert a negative influence on B(N). Such effect reflects early "despondency" among bidders.*

B. Last stage of an auction

During the last stage of an auction, the immediate consequences of aggressive bidding are similar to the ones discussed in the previous section (*i.e.* motivation *vs.* despondency effects can boost *vs.* undermine the hammer price).[10] Nevertheless, further consequences may arise when an auction ends, as strategic interactions increase while bidders are fewer. This justifies a focus on the best responses of each bidder based on conjectures about the latest competitors, especially in terms of the threat they pose. There are several reasons why bidders may (or may not) view an offer as dangerous. Firstly, the art-collecting community is a small world. Some bidders have a strong/weak reputation, which is common knowledge.[11] Secondly, the magnitude and timing of previous bids are cumulative signals (the latest being the most visible ones): bidders[12] signal their type by sending a succession of ratios p(i) during the auction. The participants use such signals to revise and assess the potential danger of any recent bid. Thirdly, the absolute level of bids also alters the bidders' beliefs about opponents, especially when symbolic thresholds have been outreached (the population of buyers obviously changes when the bids go beyond 5 000 €, 100 000 €, or 1+ million €).

Let us consider a bidder having chosen a high p(i), thus playing an aggressive strategy while the auction ends. At this stage of the sale, such decision is a strong signal, observed easily

[9] Moreover, Avery (1998) says that a bidder using jump bidding as an aggressive strategy aims at sending the message to others that (s)he has the highest value for the good and that competing with her/him puts them at risk of overbidding and losing money (*i.e.* suffering from the winner's curse) if (s)he drops out.
[10] Although the higher level of offers at this point of the auction makes it more likely that bidders are (*ceteris paribus*) closer to their hard budget constraint.
[11] At least for non-anonymous bids, which excludes Internet/phone/purchase order offers.
[12] In most auctions, each online registered buyer is given an ID number, so that it remains possible for the others to identify the bidder, despite ignoring his/her precise identity. As for offers by phone, there is one auction house staff member per call, so it remains also possible for the others to identify from which staff member over the phone the bids come from.

by opponents.[13] Here, the nature of the next offers depend mainly on the conjectures made by the remaining competitors. Suppose some of them fear that *i)* the aggressive bidder has not reached his/her reserve yet, *ii)* such reserve remains fuzzy enough to keep increasing if the auction goes on. Then, the bidder's opponents may decide to stake everything on, and strike back by playing aggressively too, which is the best way to discourage a dangerous offer[14] (of course, the ability to play such strategy is limited by the buyers' own (hard) budget constraint). In other terms, bidding high quickly saves the last chances to grab the lot, and can be the ultimate answer for competitors being the most motivated and/or whose financial latitude is narrowing. This strategy is rational when followed by bidders who are convinced that others can win the auction if it lasts too long. Overall, final bidding duels may appear when a set of players believes that a current bid is dangerous (*i.e.* it can elevate even more).[15] This can amplify the immediate consequences of aggressive bidding, as competitors bid to the maximum afterwards. This leads to (H2a).

> **H2a.** *[Amplification] When the auction ends, the consequences of aggressive bidding (cf. motivation (H1a) vs. despondency (H1b)) can amplify when opposing bidders identify such bid as dangerous, thus leading to "final bidding duels".*

Now, H2a has some counterarguments. Suppose that when facing an aggressive bid, competitors now believe that the bidder behind such offer has (nearly) reached his/her hard budget constraint (which cannot be exceeded, except in case of irresponsible bids, which we exclude from our analytical framework). Here, the best response of the opponents is to make incremental (mild) bids afterwards in order to maximize their surplus: raising further their bids is useless as they assume the current bidder to have exhausted his/her bidding margin. Hence, when a set of buyers see the current bid as a non-threatening offer, a high p(i) may be followed by milder bids, which can cancel/mitigate the consequences of aggressiveness. Namely, mild responses *i)* no longer boost the offers (thus terminating "motivation effects"), *ii)* expand time (thus tempering "despondency effects"). This leads to (H2b), as an alternative to (H2a).

[13] Among whom are bidders approaching their non-expandable hard budget constraint.
[14] Indeed, playing a low p(i) (to maximize one's individual surplus) is of less interest. On the contrary, while facing dangerous competitors, a high p(i) is the only answer left to win the lot (which includes bidders whose financial margin is shrinking with higher bids).
[15] At the end of the auction, these bidding duels can even be reinforced by a surge of pride among certain duelists deciding to increase their reserve even more to win the fight.

H2b. *[Cancellation/Mitigation] When the auction ends, the consequences of aggressive bidding (cf. motivation (H1a) vs. despondency (H1b)) can disappear/narrow when opposing bidders are confident, thus leading to "final de-escalating".*

Table 1 gathers our hypotheses on the impact of aggressive bids (*i.e.* p(i) ratios) on the hammer price (B(N)). We split them depending on the considered auction stage. When the auction ends, we distinguish the immediate consequences of aggressive bidding (high p(i)) from the further effects (competitors' strategic responses). The signs in brackets indicate the expected influence on the hammer price.

TABLE 1

Synthesis of hypotheses (expected influence of aggressive bids)

Auction starts: Aggressive bidding ► p(i)↑	Auction ends: Aggressive bidding ► p(i)↑		
	Immediate consequence	Further effects (competitors' strategic responses)	
		Opponents' beliefs → *Dangerous bid*	Opponent's beliefs → *Non-dangerous bid*
H1a: Early motivation (+)	Late motivation (+)	H2a: Final duels → amplified (+) impact	H2b: Confidence → cancelled (+) impact
H1b: Early despondency (-)	Late despondency (-)	H2a: Final duels → amplified (-) impact	H2b: Confidence → mitigated (-) impact

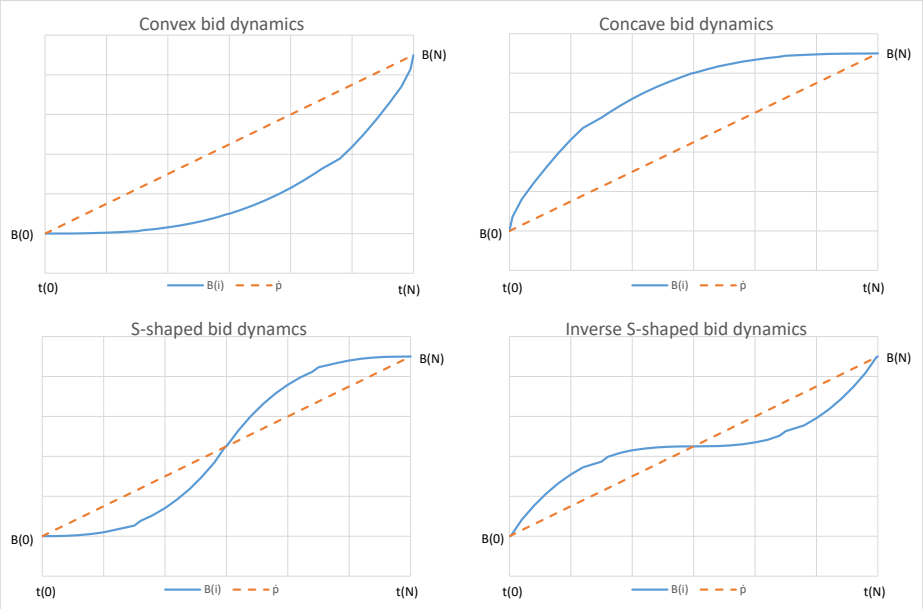
2.4.2. Influence of the pace of an auction on the price

At a given time, an aggressive bid punctually accelerates the pace of an auction, while a mild one leads to punctual deceleration. Therefore, the way succeeding aggressive/mild bids accumulate over time can modify the pace of the auction. Fast-paced auctions may stem from a steady succession of aggressive offers (many motivated buyers), or to one extremely aggressive early offer ("wipe them out" strategy). At the opposite, slow-paced sales may be due to succeeding mild bids (numerous bargain seekers) or to one soft late offer ("wait and see" strategy). When such strategies prevail at the beginning of an auction, the bid dynamics can evolve behind or ahead of "normal pace" (*i.e.* the pace of a linear auction deriving from automatic bids: *see supra*). When the auction ends, previous delays (respectively advances) lead consequently to catch-up (resp. slowing down) effects, when compared to linear (neutral) dynamics.

Figure 4 describes four alternate fictive cases showing several combinations of advances/delays and catch-up/slowdown effects, occurring at the beginning and/or at the end of the sale. The first configuration illustrates a convex auction, (*i.e.* starting slowly, which generates catching-up effects in the end). Here, the bidding curve is always below the linear (neutral) auction path. The second graph shows the reverse: concave auctions accelerate in the beginning, and decelerate afterwards. Here, all bids are above the non-strategic auction path. The third configuration (S-shaped auction) is more complex: after initial delays, the bid dynamics suddenly accelerate at midpoint, so that the auction becomes ahead of pace, just before converging late towards the linear path (*i.e.* a final slowdown). The fourth graph illustrates the reverse situation: an inverse S-shaped auction boosts when starting and ending, while decelerating at midpoint.

FIGURE 4

Auction pace (4 configurations)



There is a chance that the hammer price also depends on such non-linear dynamics affecting the pace of an auction. We now investigate this latter question by comparing the actual bid dynamics to the neutral auction path. One may observe various phases in the ongoing auction, either behind or ahead of pace: we expect such advances/delays to have various influences on the auction outcome, depending on whether they occur at the beginning or at the end of the sale.

A. Early stage of an auction

Let us focus on the early stage of an auction. At this moment, the pace of the sale may be either fast or slow depending on the nature of successive offers and the way they accumulate over time. We now distinguish both cases.

Let us consider a sale ahead of pace, while the auction begins. Let us remind here that fuzzy reserves are likely to increase when bidders have observed high previous offers (cf. "common value component" and "arousal" effects mentioned earlier). This actually happens when the auction accelerates early. This latter effect boosts the upcoming reserves of fuzzy bidders', hence the final price. A counterargument prevails however. *Ceteris paribus*, an early acceleration of bids mechanically shortens the total auction time, thus reducing further opportunities to increase everyone's reserves (*i.e.* rushing effect). We expect a negative influence on the hammer price at this level. Hypothesis H3 combines the two opposite influences.

> **H3.** *When the auction starts, being ahead of pace has contrasted influence onto the final auction price depending on the strongest effect, between common value / arousal (H3a) vs. rushing (H3b). Such influence may be positive (respectively negative) when the former is stronger (resp. weaker) than the latter.*

Let us consider the alternative case now, *i.e.* a sale behind pace during the early stage of the auction (due to the presence of bargain seekers or "wait-and-see" individual strategies). Here, the expected impact on the final price is twofold. It can be positive at first. The reason is symmetrical to the previous arguments. Namely, a slow start to the sale extends the overall auction time, thus giving (fuzzy) bidders more opportunities to update their reserves, and therefore to join/stay in the race. Overall, an initial wait has some inclusive consequences that end up boosting competition, with more chances to reach a higher price at the end of the sale (*i.e.* inclusive effect). In contrast, early delays may also have negligible impact on the hammer price, as the absence of high early offers discourages (fuzzy) bidders to elevate their reserves further (*i.e.* indifference effect). H4 summarizes both effects.

> **H4.** *When the auction starts, being behind pace has contrasted influence onto the final auction price depending on the strongest effect, between inclusion (H4a) vs. indifference (H4b). Such influence may be positive (respectively null) when the former is stronger (resp. weaker) than the latter.*

B. Last stage of an auction

Let us discuss now the last stage of an auction. At this moment, strategic interactions are stronger while remaining bidders are fewer. Again, we distinguish two polar cases, depending on the shape of the curve of bid dynamics (cf. presence of catch-up *vs.* slowing down effects). Both cases (and their related hypotheses) are discussed below.

We first consider catch-up effects at the end of sale (that mechanically follow earlier delays). This situation occurs when final bids accelerate due to the prevalence of late aggressive offers (it happens when duels emerge, now that competitors interact strategically). Indeed, the slowdown preceding final acceleration makes competitors even more dangerous as offers have remained contained for some time. This reinforces the belief that competition remains fierce and strengthens the incentive for some bidders to end the wait by going all in. At this point, the accumulation of aggressive responses amplifies the consequences of (previous) aggressive bidding (see H2a). Regarding the ensuing influence on the hammer price, one can mention two opposite effects (stemming directly from the previous arguments). On one side, stronger motivation among bidders can boost the price (as they strategically minimize their surplus to maximize their chances of winning the auction). On another side, a succession of aggressive bids has discouraging effects too. Indeed, the acceleration of bids reduces the time for reflection, leaving even less opportunity to increase (fuzzy) reserves. This latter effect can undermine the price.[16] H5 sums up these arguments.

> **H5.** *Late catch-up effects are the sign of final strategic duels (i.e. bids accelerate): "late motivation" may increase the final price (H5a). Yet, fast duels can discourage bidders too: i.e. "late despondency" may lead to a lower price (H5b).*

We last consider slowing down effects during the last phase of the sale (by construction, this situation occurs when the auction was ahead of schedule, followed then by mild final offers). Constrained bidders are mechanically closer to their hard budget limit at this point of the auction (especially those who have bid high before). *Ceteris paribus*, this raises the chances that some strategic bidders become confident about their opponents, and the threat they pose. As discussed before (see H2b), confident bidders are less aggressive, which tempers the consequences of previous (aggressive) bids on the hammer price. We then expect two distinct influences on such price. A positive one at first, as (fuzzy) bidders have more time to raise their

[16] In our view however, such negative influence is less likely when the auction ends, as fuzzy bidders have had enough time to increase their reserves, making them more difficult to discourage.

reserves while the auction decelerates. Then, a slowing down pace can (re)include bidders into the race, leading ultimately to a higher price.[17] When reaching the end however, decelerating (mild) offers may no longer boost the sale outcome. The reason is straightforward: confident bidders do not need to trim their surplus to win the auction. Both arguments lead to H6.

> **H6.** *Late slowdowns generate "inclusive effects" towards bidders who can stay in the auction, thus raising the final price (H6a). Yet, such price may not be impacted anymore, as slowdowns also reflect "confident bidding" strategies (H6b).*

Table 2 gathers our hypotheses on how the auction pace (catch-up/slowing down affects) influences the hammer price (B(N)). We separate the start from the end of an auction. The signs in parentheses signal the expected influence.

TABLE 2

Synthesis of hypotheses (expected influence of changes in the auction pace)

Auction starts		Auction ends	
Auction ahead of pace	Auction behind pace	Late catch-up (duels)	Late slowdown
H3a: Common value / Arousal effects (+) H3b: Rushing effects (-)	H4a: Inclusive effects (+) H4b: Indifference (no impact)	H5a: Late motivation (+) H5b: Late despondency (-)	H6a: Inclusive effects (+) H6b: Confidence (no impact)

Once the hypotheses have been presented, we will detail in the next section our indexes related to the bid dynamics which allow to test for these hypotheses.

3. Bid dynamics indexes

This section introduces our indexes on bid dynamics. Those aim to summarize such dynamics during the three major phases of an auction, *i.e.* when the sale starts, ends, and is at midpoint. As discussed before, the context drastically changes depending on the considered phase, which requires separating them. We compute six indexes in total, of two types. The first set of indexes (three indexes) captures the degree of aggressiveness of bids, at the start (S),

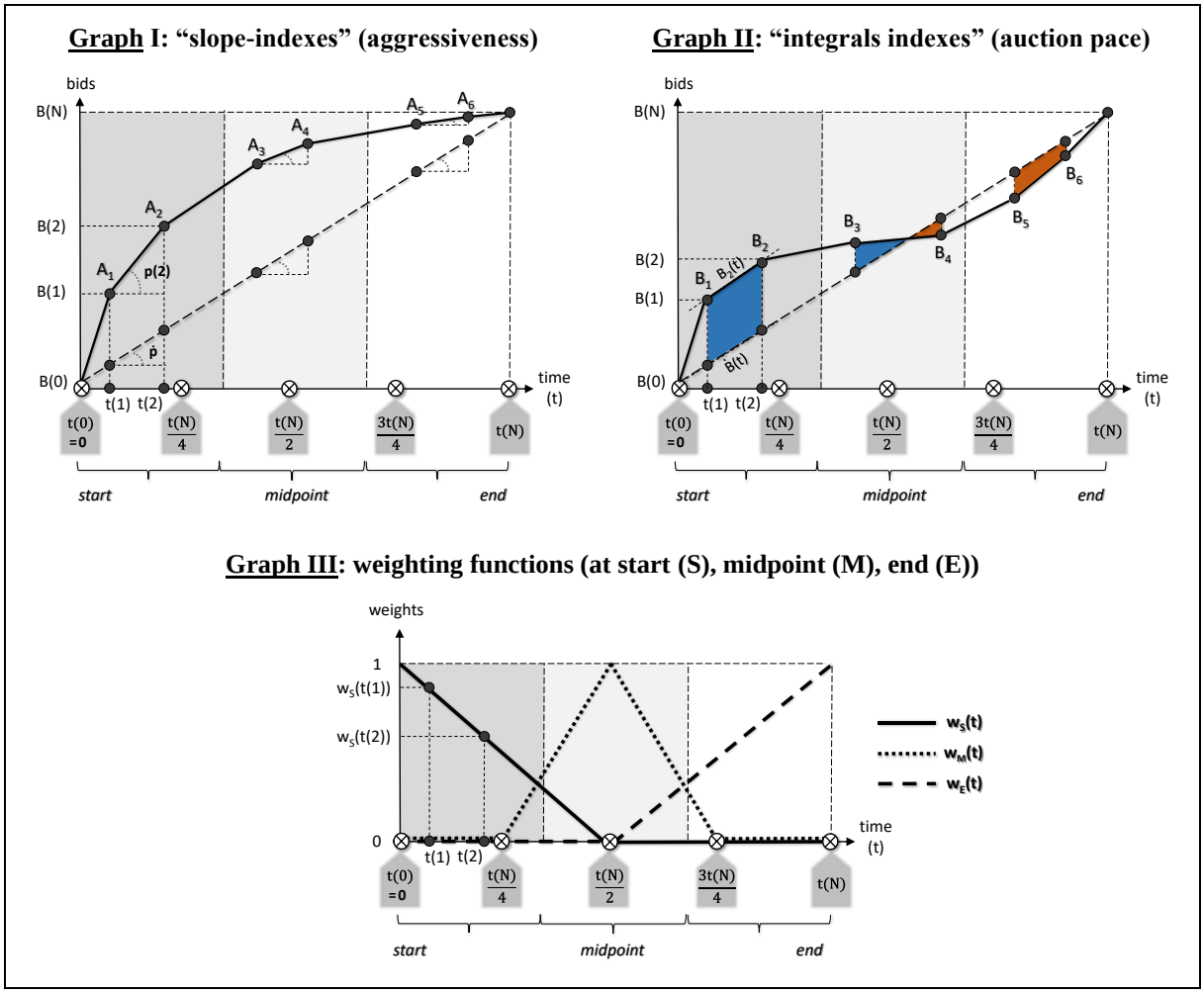
[17] That said, we do not expect such positive influence to dominate when the auction ends, as higher bids at that point may no longer attract competitors who have (almost) exhausted their financial margin.

midpoint (M), end (E) of the auction, denoted respectively IBID_SL$_{(S)}$, IBID_SL$_{(M)}$, IBID_SL$_{(E)}$.[18] The second set (three indexes) measures advances/delays of the auction pace, again computed for the three main phases of the sale. We denote them IBID_IN$_{(S)}$, IBID_IN$_{(M)}$, IBID_IN$_{(E)}$.[19]

Figure 5 illustrates how our indexes actually work. The two first graphs (I and II) relate to each category of index: *i)* aggressiveness, *ii)* auction pace. Both graphs synchronize with the third one (III) showing how indexes are weighted differently depending on the phase of the sale.

FIGURE 5

Weighted indexes accounting for bid dynamics (aggressiveness and auction pace)



[18] IBID stands for "Index-Bidding". "SL" stems from the fact that the level of bidding aggressiveness is measured as a difference in slopes. "(S)/(M)/(E)" relates to the auction time (start, midpoint, end). Each index is computed in relative terms (*i.e.* divided by a constant benchmark).

[19] The naming is similar to the three previous indexes. Here, "IN" stems from the fact that we compute differences in integrals to capture the pace changes during the sale.

Let us first consider "IBID_SL" indexes that summarize how aggressive bids are. Graph I illustrates a succession of seven offers, from B(1) (first bid) to B(N) (7th bid that leads to the hammer price), while B(0) represents the auction starting price at time t(0) = 0. Let us consider two offers: B(2) that follows B(1), made at times t(2) and t(1) respectively (points A_2 and A_1 correspond to their crossing points). We measure how aggressive offer B(2) is by computing slope p(2) (as seen above: p(2) = (B(2)-B(1))/(t(2)-t(1)) = ΔB(2)/Δt(2)).[20] Then, we compare p(2) to (ṗ), the invariant slope attached to the neutral auction path. Namely, we compute the difference p(2)-ṗ, which gets normalized by dividing by constant (ṗ).

At this level, one must introduce weighting functions, denoted $w_j(t(i))$, to account for the time the i^{th} bid (B(i)) was made (remind there are three indexes, one for each auction phase). Suppose that we first compute $IBID\_SL_{(S)}$, *i.e.* the index attached to the starting stage of the sale. Here, the weighting function corresponds to the plain curve appearing in graph III. This curve ($w_S(t)$) linearly declines from one at time 0, to zero at time t(N)/2 (*i.e.* the midpoint of the sale). Hence, offer B(2) has a lower weight than B(1) as it comes later. Beyond midpoint time, any subsequent bid has null weight (indeed, the latter bids are closer to the end of the auction). The second (small-dotted) curve ($w_M(t)$) represents the weights describing the mid-stage of the sale. Those weights are maximized (equal to 1) at time t(N)/2, and decrease when moving away from this point: they are null at times t(N)/4 and 3t(N)/4. Here, a bid made at midpoint has the maximum weight when computing $IBID\_SL_{(M)}$. The third (broad-dashed) increasing curve ($w_E(t)$) shows how weights accounting for the last stage of the auction increase from zero (at time t(N)/2) to one (at time t(N)). Therefore, an offer made at time t(N) has the strongest weight as regards $IBID\_SL_{(E)}$.

Equation (1) gives the computation of $IBID\_SL_{(j)}$ indexes, where (j) represents one of the three main phases of the auction: j = {S} (starting auction), j = {M} (auction at midpoint), j = {E} (ending auction).

$$IBID\_SL_{(j)} = \sum_{i=1}^{N} \frac{p(i) - \dot{p}}{\dot{p}} \cdot w_j\big(t(i)\big) \qquad (1)$$

with:

$$p(i) = \frac{\Delta B(i)}{\Delta t(i)} = \frac{B(i) - B(i-1)}{t(i) - t(i-1)} \quad \text{and} \quad \dot{p} = \frac{B(N) - B(0)}{t(N) - t(0)} = \frac{B(N) - B(0)}{t(N)}$$

[20] We could do the same computation, when comparing B(1) to B(0), B(3) to B(2), etc. until B(7) to B(6).

$$w_j(t) = \begin{cases} 1 - \dfrac{2}{t(N)} \cdot t \ , \forall t < \dfrac{t(N)}{2} & (0 \text{ otherwise}), \text{when } j = \{S\} \\ -1 + \dfrac{4}{t(N)} \cdot t \ , \forall t \in \left[\dfrac{t(N)}{4}; \dfrac{t(N)}{2}\right] & \\ 3 - \dfrac{4}{t(N)} \cdot t \ , \forall t \in \left[\dfrac{t(N)}{2}; \dfrac{3t(N)}{4}\right] & (0 \text{ otherwise}), \text{when } j = \{M\} \\ -1 + \dfrac{2}{t(N)} \cdot t \ , \forall t > \dfrac{t(N)}{2} & (0 \text{ otherwise}), \text{when } j = \{E\} \end{cases}$$

Let us now consider "IBID_IN" indexes that recap the pace of the auction. Graph II shows seven succeeding offers (from B(1) to B(7)), forming an inverse S-shaped bidding curve. We focus on point B_2 (t(2);B(2)) following B_1 (t(1);B(1)). Both points cross the times and amounts of the two first bids. We denote as $B_2(t)$ the line that links both points (by construction, its slope is p(2)). We also consider $\dot{B}(t)$, the line showing the neutral auction path. By definition, this latter line has a slope equal to ($\dot{p}$) and passes through points (t(0);B(0)) and (t(N);B(N)). Once bid n°2 is made, the sale is all the more ahead of pace as line $B_2(t)$ is above line $\dot{B}(t)$. The area between both lines is positive (respectively negative) when the sale is ahead of (resp. behind) the neutral auction path, our benchmark. On Graph II, the former (resp. latter) case corresponds to the blue (resp. red) regions. On the (continuous) time interval [t(1);t(2)], such area corresponds to the integral of $B_2(t)$-$\dot{B}(t)$. We normalize this difference by dividing by the constant value B(N)-B(0) (*i.e.* the two extreme offers).

As for the previous index, such integral is weighted by function $w_j(t)$ on the considered time interval (with j set to {S},{M},{E} depending on the considered auction phase: see Graph III). Overall, the resulting $IBID\_IN_{(j)}$ indexes aggregate the weighted integrals on all bids (from the first (B(1)) to the last one (B(N)). This leads to equations (2a) (general formula) and (2b) (explicit formula).

$$IBID\_IN_{(j)} = \sum_{i=1}^{N} \int_{t(i-1)}^{t(i)} \frac{B_i(t) - \dot{B}(t)}{B(N) - B(0)} \cdot w_j(t) dt \qquad (2a)$$

with:

$B_i(t)$: line passing through points $\big(t(i-1); B(i-1)\big)$ and $\big(t(i); B(i)\big) \rightarrow$ slope $= p(i)$

$\dot{B}(t)$: line passing through $\big(t(0); B(0)\big)$ and $\big(t(N); B(N)\big) \rightarrow$ slope $= \dot{p}$ and $t(0) = 0$

$w_j(t)$: weighting function, as defined above (j$\in[S; M; E]$)

Hence the explicit formula:

$$IBID\_IN_{(j)} = \sum_{i=1}^{N} \int_{t(i-1)}^{t(i)} \frac{B(i) - p(i)t(i) - B(0) + (p(i) - \dot{p})t}{B(N) - B(0)} \cdot w_j(t)dt \qquad (2b)$$

A major difference with the "IBID_SL" index is that "IBID_IN" is invariant to the number of bids actually made, as it considers a continuous bid dynamics, thus capturing the general rhythm of an auction, which should not depend on how many offers were made during the sale.

Appendix 1 provides several simulated scenarios, and shows how "IBID_SL" and "IBID_IN" indexes vary with the shape of various (fictitious) auctions. As expected, all indexes take on zero values when bids align with the neutral auction path.

4. Data and methodology

We first present our sample (4.1.) and the data collection (4.2.), then the variables and descriptive statistics (4.3.), lastly the model (4.4.).

4.1. The sample

Our dataset consists of prices, sequences of bids and characteristics of 547 art lots sold at auction between March 2017 and May 2018 by six different auction houses. These lots were auctioned following the traditional type of auction used on the art market, *i.e.* the ascending-bid auction, also called the open, oral or English auction. Regarding the auction houses we selected in our sample, they organize their auction sales on-site, with a professional auctioneer conducting the sale. The auctioneer opens the auction by announcing a starting price and bidders call out prices successively until only one bidder remains, and that bidder acquires the product at the last price (s)he announces. Bidders can bid from the room, by phone, on the Internet, or with purchase order.

We focus on the European comic art market, *i.e.* the lots of our sample are original comic artworks auctioned in Paris and Brussels between March 2017 and May 2018. All main brick-and-mortar auction houses which organize dedicated sales on a regular basis are represented in our sample, apart from Vermot et Associés, since this auction house does not provide all images of the lots for sale. We count 40% of our sampled lots auctioned at Christie's,

20% at Artcurial, 9% at Coutau-Bégarie, 10% at Cornette de Saint Cyr, 12% at Millon and 9% at Huberty-Breyne. This distribution thus includes 40% of lots from prestigious sales (Christie's sales) with an average mean-estimate (midpoint between high and low pre-sale estimates) of 13 939 €, 20% of lots from top range to mid-range market (Artcurial sale) with an average mean-estimate of 6 294 € and 40% of lots from mid-range to low-end market (sales by Coutau-Bégarie, Cornette de Saint Cyr, Millon and Huberty-Breyne) with an average mean-estimate of 1 053 €. The auction sales by Millon and Huberty-Breyne took place in Brussels, the others in Paris.

We remove nine transactions that can be classified as outliers from our sample, as our indexes take extreme values for these observations. Therefore, the present analysis is restricted to 538 artworks.

4.2. Data collection

We construct an original dataset by collecting manually all information about prices, sequences of bids, characteristics of the sale environment and of the lots.

The information about the sequences of bids were gathered from video recordings of the auction sales. Indeed, as mentioned above, the auction houses of our sample allow to bid online, and therefore transmit live their sales on the Drouot Live platform (for Coutau-Bégarie, Cornette de Saint Cyr, Millon and Huberty-Breyne), or on their own live platforms (for Christie's and Artcurial). Thus, we record the auction sales thanks to the software *ActivePresenter*©. These videos enable us to collect the timing and the amount of each bid, from the starting price to the final price.

To control for the heterogeneity of the artworks, we gather data about their characteristics, by using catalogues provided by auction houses to customers before sale. These catalogues present each lot for sale with a description and an image of it. For some variables related to the artist or to the popularity of the artwork, we also use the specialized comic website Bédéthèque©[21].

Finally, to control for the heterogeneity of the auction sales, we gather data on the sale environment, using the catalogues, the videos of the sales and by screening the websites of French and Belgian auction houses that regularly organize original comic dedicated sales.

[21] https://www.bedetheque.com/

4.3. The variables and descriptive statistics

Descriptive statistics are given in Table 3. The dependent variable is the auction price of each artwork. We consider the hammer price, *i.e.* the last bid of the auction which is the price paid by the winning bidder to which transaction costs are added afterwards. The explanatory variables are organised in three categories. The average hammer price in our sample is 7 064 €, while half of our lots have been hammered under 3 000 €. Hammer prices range from a low price of 60 € to a high price of 200 000 €. The mean price per square centimetre is 6.33 € when the median is 2.35 €. Prices for one square centimetre of artwork range from 0.04 € to 143.61 €.

The first set of variables – and our variables of interest – consists of our bid dynamics indexes at the different phases of the auction, as detailed in section 3. We have two types of indexes: the first type ($IBID\_SL_{(j)}$) tells about the degree of aggressiveness of punctual bids and the second type ($IBID\_IN_{(j)}$) reflects phases of acceleration or deceleration in the auction of a lot. For each of this type, there is an index for the beginning, middle and end of the auction.

Regarding $IBID\_SL_{(j)}$, a positive value of this index means an aggressive bid, whereas a negative value accounts for a mild bid. On average for our 538 auctioned lots, this index at the start of the auction takes the value of 3.24, so that we generally observe aggressive bids at the beginning of the auction. The median of this index at the beginning is yet below, at 0.44, which means that our sample includes lots with particularly aggressive bids at the beginning. Indeed, we observe that the maximum value of the index at the start of the auction is 64.73, while the minimum value is -2.87. During the middle of the auction, the degree of aggressiveness of bids is generally lower: the index ranges from -1.51 to 34.01, with an average value of 1.42. At the end of the auction, bids are more aggressive on average than at the middle of the auction but less than at the beginning of the auction (average index of 1.84), although the index takes its highest value (71.01) at the end of the auction.

With respect to $IBID\_IN_{(j)}$, a positive value reflects an auction ahead of pace and a negative value indicates an auction behind pace. At the beginning of the auction, we observe that auction is on average slightly in advance compared to pace of the linear auction, as the mean value for this index is 0.07. Yet, the bid dynamics of more than half of our sampled lots are starting slowly (median at -0.11 for this index at the beginning). This means that the pace for some of our auctioned lots is particularly fast at the beginning, explaining why we observe a positive average index at the starting phase. At the middle of the auction, the mean index is positive (at 0.20) so that the auction dynamics are on average ahead of pace. At the end of the

auction, the average index is slightly negative (-0.05). This means that on average the auctions are behind of pace, which corresponds to catch-up effects. Yet, the median index for the end of the auction is just above zero (0.03) so that the bid dynamics of slightly more than half of our auctioned lots are slowing down. Again, it appears that our average index at the end is driven by some of our auctioned lots characterized by important late catch-up effects.

The next set of variables gathered relates to the sale characteristics, in order to control for the heterogeneity in the auction sale environment. We include a dummy variable that equals 1 when sales are held by Christie's (and 0 otherwise), as they are prestigious comic art sales organized by a leading auction house. Many studies have shown that this auction house, along with Sotheby's, systematically obtains higher prices compared to other auction houses (Pesando 1993, De la Barre *et al*. 1994, Renneboog and Van Houtte 2002, Hodgson and Vorkink 2004, among others). The nature of the sale (prestigious or not) and the reputation of the auction house may attract different bidders and induce distinct strategies. In our sample, 40% of the lots are auctioned by Christie's. Moreover, we account for the level of competition with other similar sales by introducing the variable *other sales* that captures the number of other sales dedicated to comic art 15 days before and after the sale. The given supply of artworks for sale might indeed change bidders' behaviour. For the auction sales of our sample, the number of competing sales varies between 0 and 4, being on average of 1.64. Then, auction houses sometimes add a positive comment in the lot description of the catalogue like "beautiful piece of art" or "exceptional quality". This concerns 58% of our lots. We include a dummy variable *positive comment* that equals 1 if the description contains such a comment (0 otherwise), as praise of a lot can influence bidders. We also take into account the lot order (in percentage of the total number of lots), as bidding is likely to differ when the lot is among the first to be presented for sale or among the last. Indeed, bidders' energy, excitement and interest for the auction as well as the auctioneer's performance and patience might change over the period of the auction sale. In addition, we generate a variable (*number lots author*) to captures the number of lots per artist for sale. We can actually think that when bidders have the choice between different lots from an artist they are interested in, they will bid differently compared to a situation when they only have one chance to acquire an artwork from this artist. Half of our lots are sold with at least two other lots from the same artist in the same auction sale. The range of lots per artist goes from 1 to 32, as for two sales of our sample, a part was dedicated to an artist. Last, we include two variables related to the live auction. The first one stands for the duration of the lot description, *i.e.* the number of seconds taken by the expert/auctioneer to describe the lot which will be

auctioned. Half of the descriptions are read in less than 5 seconds and the reading time ranges from 1 to 39 seconds. The second variable measures the average time in seconds between each bid for a lot. This time is one average of a bit more than 6 seconds for our sampled lots and for half of the lots, the average time between bids is less than 5 seconds.

The third set of variables aims at controlling for the heterogeneity between artworks, including characteristics of the artist and of the work. The first variable captures the artist's recognition, taking the form of a dummy equaling 1 if the artist has received an award in her/his life, 0 if not. It is well-recognized that one of the most important price determinant on the art market is the reputation and quality of the artist. In our sample, 24% of the lots have been created by an artist that has been honoured by an award for his/her career. Then, we generate a variable accounting for the living status of the artist, a dummy which takes the value of 1 if the artist is deceased, 0 if (s)he is still alive at the time of the auction sale. A positive effect of the artist's death on price has often been found (Agnello and Pierce 1996, Ekelund et al. 2000, Higgs and Worthington 2005). Art lots from deceased artist represent 38% of our sample.

We then account for the popularity of the artwork, with a variable indicating the number of publications the comic artwork has been subject to. Indeed, comic artworks have an "hybrid" nature : they are unique works of art drawn by an artist and at the same time they are commercial goods gathered and published in the form of comic books for the purpose of being sold on a large scale. Thus, the number of publications of the comic book from which the artwork stems – the median number of publications is 2 in our sample – reveals the popularity of the artwork. We also consider the presence of the artist's signature, a proof of authenticity, taking the form of a dummy variable which equals 1 if the artwork is signed, 0 if not. In our sample, 62% of the lots are signed. Finally, we include physical attributes of the artworks that are considered to be determinants of the price: the size (represented in surface area in square meter), the condition of the artwork (dummy variable), the type of comic artwork (dummies for the different types), the medium (dummies for each medium) and the subject matter(s) (dummies for the various topics). The average size for an artwork in our sample is 0,19 square meters. 8% of the artworks are damaged, *i.e.* being affected by retouching, patches, tears or yellowing. With respect to the type of comic art, 11% of our artworks are coverpages, 28% are illustrations and 61% are other types, mainly boards and a few drafts. "Other types" is omitted in our regressions to serve as a benchmark. As for the medium, most of the artworks (84%) are inked, 40% have been painted, 17% include pencil strokes and a few (4%) have been done with feltpen, pasting or mixed medium. In our regressions, the reference category is the ink medium. The represented topics

of our artworks are numerous, the most common (depicted in more than 20% of our artworks) being action, adventure/suspense, archetypes, genre scenes and social interaction.

TABLE 3

Descriptive statistics

Variables		Mean	Median	Std Dev	Min	Max
Price						
Hammer price		7 064.80	3 000.00	14 390.93	60.00	200 000.00
Price buyer's premium incl.		8 888.75	3 761.00	17 856.12	76.00	242 500.00
Price per cm2		6.33	2.35	13.41	0.04	143.61
IBID indexes						
IBID_SL(START)		3.24	0.44	8.43	-2.87	64.73
IBID_SL(MIDDLE)		1.42	0.33	3.22	-1.51	34.01
IBID_SL(END)		1.84	0.33	6.29	-1.38	71.01
IBID_IN(START)		0.07	-0.11	1.02	-3.73	6.32
IBID_IN(MIDDLE)		0.20	0.00	1.59	-11.93	7.45
IBID_IN(END)		-0.05	0.03	1.04	-7.00	3.94
Control variables related to the sale context						
Christies (0/1)		0.40	0	0.49	0	1
Other sales		1.64	1	1.32	0	4
Description time		5.60	5	3.36	1	39
Mean time between bids		6.46	4.89	6.21	0.32	62.00
Positive comment (0/1)		0.58	1	0.49	0	1
Lot order (% of total number of lots)		0.49	0.49	0.29	0.01	1.00
Number lots author		5.12	3	7.27	1	32
Control variables related to the artist and lot						
Artist's Award (0/1)		0.24	0	0.43	0	1
Death (0/1)		0.38	0	0.49	0	1
Number of publications		4.92	2	8.81	0	141
Signature (0/1)		0.62	1	0.49	0	1
Size (m2)		0.19	0.15	0.22	0.01	2.44
Condition (0/1)		0.08	0	0.27	0	1
Type (0/1):	Coverpage	0.11	0	0.31	0	1
	Illustration	0.28	0	0.45	0	1
	Other	0.61	1	0.49	0	1
Medium (0/1):	Ink	0.84	1	0.37	0	1
	Paint	0.40	0	0.49	0	1
	Pencil	0.17	0	0.38	0	1
	Feltpen	0.04	0	0.19	0	1
	Pasting/mixed medium	0.04	0	0.18	0	1
Subject matter (0/1)	Action	0.21	0	0.41	0	1
	Ads	0.02	0	0.15	0	1
	Adventure/suspens	0.24	0	0.43	0	1
	Archetypes	0.24	0	0.43	0	1
	Arts	0.04	0	0.20	0	1
	Death	0.03	0	0.16	0	1
	Erotism	0.16	0	0.37	0	1
	Fantasy/Magic	0.12	0	0.33	0	1
	Genre	0.24	0	0.43	0	1
	Historical context	0.10	0	0.30	0	1
	Homage	0.04	0	0.20	0	1
	Humor	0.16	0	0.37	0	1
	Interaction	0.21	0	0.41	0	1
	Landscape	0.19	0	0.39	0	1
	Love	0.05	0	0.23	0	1
	Portrait	0.15	0	0.36	0	1
	Science-fiction/high-tech	0.09	0	0.29	0	1
	War/violence	0.11	0	0.31	0	1

4.4. The model

The analysis with indexes by phase of the sequence of bids allows to keep a simple model, in order to shed light on the influence on prices of punctual bids' aggressiveness and of the auction pace at the main moments of a sale. We use the hedonic regression methodology, commonly found in studies on the art market. Our model relates hammer prices (log) to our bid dynamics indexes, while controlling for a wide range of hedonic characteristics such as the sale environment, artist and work features. Our specifications are the following (one for each type of index, $IBID\_SL_{(j)}$ and $IBID\_IN_{(j)}$, to avoid any risk of multicollinearity):

$$\ln p_i = \alpha + \sum_j \beta_j IBID\_SL_{(j),i} + \sum_m \gamma_m Sale_{m,i} + \sum_n \delta_n Artist_{n,i} + \sum_p \theta_p Artwork_{p,i} + \varepsilon_i \quad (3)$$

$$\ln p_i = a + \sum_j b_j IBID\_IN_{(j),i} + \sum_m c_m Sale_{m,i} + \sum_n d_n Artist_{n,i} + \sum_p e_p Artwork_{p,i} + \varepsilon_{u,i} \quad (4)$$

where $\ln p_i$ is the log of the hammer price of artwork *i (i* = 1, …, *N)*, $IBID_{SL(j),i}$ is the index value capturing the degree of aggressiveness of bids at phase *j (j* ={S},{M},{E}*)* of artwork *i,* $IBID_{IN(j),i}$ is the index value measuring the advance/delay of the auction pace at phase *j (j* ={S},{M},{E}*)* of artwork *i,* $Sale_{m,i}$ is sale-level attribute *m* (*m*=1, …, *M*), $Artist_{n,i}$ is the measurable artist-related attribute *n* (*n*= 1,…, *N*) of artwork *i,* $Artwork_{p,i}$ is artwork-specific feature *p* (*p*=1, …, *P*), $\beta, \gamma, \delta, \theta, b, c, d$ and e are unknown coefficients that represent the implicit prices of the linked characteristics, and ε_i and $\varepsilon_{u,i}$ are the error terms.

5. Results and robustness checks

5.1. Results

Table 4 shows our OLS estimates on two models. Model 1 focuses on the aggressiveness of offers ("IBID_SL" indexes). Model 2 relates to the pace of the auction

("IBID_IN" indexes). Overall, VIF statistics (1.35 and 1.49 on average for models 1 and 2 respectively, with a maximum value of 3.27) confirm that such risk does not affect our estimates on separate models. Both regressions rely on 538 observations (auctioned lots) and use identical control variables (context of the sale, artist profile and lot features).

We first discuss the estimates on our test-variables (*i.e.* bid dynamics indexes). We focus on their sign and magnitude, as OLS parameters also account for marginal effects.

In Model 1, all "IBID_SL" indexes accounting for bidders' aggressiveness are significant and positive; whatever the considered stage (*i.e.* "start"," midpoint", "end"). This noteworthy finding confirms that bidding strategies are not neutral on the outcome of the auction (neutral strategies would have led to non-significant estimates, for all indexes). Following our theoretical framework, this confirms the importance of fuzzy reserves that give (fuzzy) bidders rationale to bid aggressively *vs.* mildly. Aggressive bidding during the early stage of the auction has the most significant influence (1% level) and shows a higher magnitude (1.9%) than when the auction ends (1.2%).[22] Aggressiveness has similar influence on price at the midpoint of the sale (2.2%) but is less significant (10% level) than at the beginning or end. These estimates confirm hypothesis (H1a) and reject its alternative (H1b). Precisely, early motivation among potential buyers (that leads them to bid aggressively) has the strongest positive impact on the hammer price.

This effect lasts until the end of the auction ($IBID\_SL_{(E)}$ remains positive), but its magnitude becomes 40% lower *in fine*. In our view, such narrowing magnitude can reveal the following mechanism. Remind that aggressiveness has two opposite influences: one is positive due to motivation, another one is negative because of despondency. This latter (depressing) effect can be exacerbated in case of ultimate strategic duels (see H2a). Hence, the smaller (positive) impact of $IBID\_SL_{(E)}$.

Overall, we find that motivation (H1a) has stronger impact on the final price than despondency (H1b). By shortening time (cf. "late despondency" effect), ultimate duels (H2a) seem to attenuate the positive influence of aggressiveness when the auction ends.

[22] These percentages show how the final price (in log) increases after a 1% increase of the considered index.

TABLE 4

OLS regressions: Dependent variable: hammer price (N=538)

Variables		Model 1	Model 2
IBID_SL(START)		0.019 ***	
IBID_SL(MIDPOINT)		0.022 *	
IBID_SL(END)		0.012 **	
IBID_IN(START)			0.129 **
IBID_IN(MIDPOINT)			0.013
IBID_IN(END)			-0.138 **
Control variables related to the sale context			
Christies (0/1)		1.388 ***	1.397 ***
Other sales		-0.693 ***	-0.727 ***
Description time		0.034 ***	0.036 ***
Mean time between bids		0.019 ***	0.018 ***
Positive comment		0.483 ***	0.448 ***
Lot order (% of total number of lots)		0.173	0.132
Number lots author		0.322 ***	0.328 ***
Control variables related to the artist and lot			
Artist's Award (0/1)		0.748 ***	0.795 ***
Death (0/1)		-0.047	-0.025
Number of publications		0.450 ***	0.472 ***
Signature (0/1)		0.059	0.065
Size (m2)		0.305 ***	0.333 ***
Condition (0/1)		-0.123	-0.152
Type (0/1):	Coverpage	0.657 ***	0.663 ***
	Illustration	0.532 ***	0.598 ***
Medium (0/1):	Paint	0.247 ***	0.264 ***
	Pencil	0.249 **	0.272 ***
	Feltpen	0.336 *	0.340 *
	Pasting/mixed medium	0.109	0.149
Subject matter (0/1)	Action	0.151	0.153
	Ads	0.139	0.076
	Adventure/suspens	0.126	0.105
	Archetypes	0.092	0.097
	Arts	0.603 ***	0.645 ***
	Death	0.103	0.012
	Erotism	-0.106	-0.109
	Fantasy/Magic	0.156	0.106
	Genre	0.320 ***	0.296 ***
	Historical context	0.165	0.143
	Homage	0.289	0.241
	Humor	0.106	0.115
	Interaction	-0.073	-0.067
	Landscape	0.157	0.136
	Love	0.329 *	0.317 *
	Portrait	0.265 **	0.246 *
	Science-fiction/high-tech	-0.235 *	-0.244 *
	War/violence	-0.083	-0.080
Constant		5.741 ***	5.890 ***
F		34.92	33.48
R^2 / Adjusted R^2		0.738 / 0.716	0.729 / 0.708

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

We now turn to Model 2 capturing how the auction pace influences the hammer price ("IBID_IN" indexes). Let us first consider a starting sale: we find that the higher $IBID\_IN_{(S)}$ (*i.e.* the more the auction is ahead of pace), the upper is the price. This finding – in line with hypothesis (H3a) – confirms the notable role of early arousals on the outcome of an auction. This finding also supports the argument that first offers reveal information about the common value of an artwork, which bidders internalize during the auction (D'Souza and Prentice 2002, Ku et al. 2005). Conversely, our estimates do not corroborate the negative influence on price of early rushing (H3b), nor any other alternative effects that would arise from slow bidding at the start, such as inclusion (H4a) or indifference (H4b: this latter effect would have led to insignificant estimates).

Thus, the initial stage of an auction appears crucial for the outcome of the auction. Nevertheless, such influence disappears afterwards, as we do not observe any significant influence of acceleration/deceleration phases in the middle of the sale. From that view, one can consider the midpoint time as a transition phase between initial advances/delays and final catching-up/slowing down phases. Overall, these transitory effects may compensate, with no definitive impact on the price.[23]

Last, what is happening during the last stage of the auction is remarkable: a higher $IBID\_IN_{(E)}$ index significantly decreases the price. Remind that this index is positive when the late bidding curve is above the neutral auction path, *i.e.* reflecting final slowdown. Conversely, it becomes negative in case of late catch-up. As this index is negative on average (-5%, cf. descriptive statistics), we discuss here the latter situation.[24] As suggested before, ultimate duels accelerate the pace of the sale, hence two opposite influences on the price. On the one hand, duels are the sign of (late) motivation among bidders, which may increase the price eventually (H5a). On the other hand, fast duels may discourage bidders quickly, with a reverse impact on price (H5b). The negative influence of $IBID\_IN_{(E)}$ (lower than zero in case of late catch-up) supports the former hypothesis (*i.e.* H5a).

In terms of magnitude, the (positive/negative) influence of the pace of an auction on the price is similar regardless of when they occur. Indeed, the corresponding estimates are close (provided they are significant): around 13-14% in absolute terms.

[23] This may also (partially) support hypothesis (H4b) according to which slowdowns can generate indifference among bidders, with no significant impact on the hammer price.

[24] The opposite extreme case would be a high and positive $IBID\_IN_{(E)}$ index (*i.e.* late slowdown). Here, we would expect either a positive influence (due to inclusive effects: H6a) or no impact at all (due to the presence of confident bidders: H6b). Our estimates reject both hypotheses as we find a significant and negative influence of $IBID\_IN_{(E)}$ on the price.

Table 5 gathers the hypotheses validated in Models 1 and 2. There are four of them (H1a, H2a, H3a, H5a). We can summarize them as follows. The auction outcome benefits from the presence of (early and late) "motivated bidders", *i.e.* potential buyers who do not look for a bargain, but rather prompt to trim their surplus to win the auction. Initial arousals, which provide valuable information on the artwork's common value, also boost the price. When the auction ends, final duels (slightly) temper the influence of punctual aggressiveness. Overall, those effects seem stronger than despondency or inclusive effects.

TABLE 5

Validated hypotheses (Models 1 and 2)

Auction starts*	**Auction ends***
Aggressive bidding ► p(i)↑ H1a: Early motivation (+)	**Aggressive bidding ► p(i)↑** H1a remains valid (+) but attenuated by: H2a (final duels)
Auction ahead of pace H3a: Common value / Arousal effects (+)	**Late catch-up (duels)** H5a: Late motivation (+)

(*) The sign in parenthesis shows the observed influence on price.

As for the control variables, the sale context firstly plays a role in determining final prices. Artworks auctioned by Christie's, those for which the auctioneer/expert has taken the time to read the description or those which are subject to positive comments all generally achieve higher prices than those auctioned by other auction houses, whose description has been partially or not read at all or which are not featured with positive comments. Also, artworks which are sold with other artworks from the same artist seem to benefit from an attraction effect of potential buyers interested by this artist which could explain why the number of lots of the same artist has a significant and positive influence upon prices. Moreover, the higher is the number of other similar sales close in time, the lower are auction prices. Lastly, the mean time between bids exhibits a positive relationship with the final price.

Secondly, artist's and artwork's characteristics contribute to auction prices. We unsurprisingly observe a highly significant and positive impact of the artist's recognition (measured by the awarding of the artist or not during her/his life) on art prices. Likewise, our estimates show that the popularity of the artwork (assessed by the number of publications) has a significant and positive influence upon the price. A finding that has been reported by economists for a long time, namely that the size of an artwork plays a role in explaining art

prices, is confirmed in our results: bigger artworks achieve on average higher prices. Regarding the physical attributes of the comic artworks, coverpages and illustrations call for a premium compared to boards. The paint, pencil and feltpen media result in increases in prices compared to the ink medium. Finally, we find that different subject matters have a significant effect on comic art prices. Topics that refer to the arts, to genre scenes, to love or portrait are positively associated with higher auction prices, whereas the science fiction/high-tech subject matter is associated with lower prices.

5.2. Robustness checks

The previous findings do not consider that the population of potential buyers may change with the types of auctioned lots, hence the strategies too. Indeed, fuzzy behaviors are likely to vary with the considered lot, from the cheapest ones to the most expensive and prestigious artworks. Furthermore, one does not expect bidding strategies to be the same depending on the overall duration of the sale. Obviously, longer auctions provide more time to readjust fuzzy reserves and give the bidders more information to revise their beliefs on the actual level of competition. We explore this avenue by estimating several models more, as robustness checks. In section 5.2.1, we focus on two sub-samples of auctioned lots, depending on their pre-sale estimates. In section 5.2.2, we analyze the robustness of our findings by separating sales depending on their duration.

5.2.1. Role of the experts' estimates

We focus here on two sub-samples of auctioned lots, depending on their average estimates, as it appears in the auction catalogues (those are set by the auction house's experts).

The first analyzed sub-sample consists of the 75% most expensive auctioned lots (*i.e.* artworks with a mean estimate above the first quartile). This gives a first group of 403 lots. Models 3 and 4 (Table 6, Appendix 2) give our estimates on this first set of observations. Model 3 shows that the positive influence of aggressive bids on the price restricts to the early stage of the auction. Namely, $IBID\_SL_{(S)}$ remains significant (1% level) and positive, in line with (H1a). Yet, the "motivation argument" that goes together with aggressive bidding loses its influence during the following stages of the auction, until its ending point ($IBID\_SL_{(E)}$ is not significant anymore in Model 3). In our view, this does not contradict the main framework. On the contrary, such result is quite logical as it relates to the bidders' strategic responses when the

auction ends. We suggest the following interpretation. For the most expensive estimated lots, the ending phase of an auction corresponds to higher offers, in absolute value. *Ceteris paribus*, the chances that remaining bidders are close to their hard budget constraint are thus stronger. In such context, the room for aggressiveness becomes limited (more than at the beginning). Thus, the (late) "motivation argument" discussed earlier has less impact on the price, hence a non-significant $IBID\_SL_{(E)}$ index.

Considering now Model 4 (*i.e.* pace of the auction), we still find a negative influence of $IBID\_IN_{(E)}$ but at the 10% level only, while $IBID\_IN_{(S)}$ no longer exerts any influence. On our sample, final duels are more important than slowdowns (the average $IBID\_IN_{(E)}$ equals -5%), and this trend is even more pronounced for the most expensive lots (-8% for the 25% highest estimated ones). Thus, we interpret the negative influence of $IBID\_IN_{(E)}$ (*i.e.* the lower this index, the higher is the hammer price) as a consequence of exacerbated motivation during the duels that occurs when the auction ends.

Let us now focus on the second subsample that comprises 75% of the lowest estimated lots (*i.e.* artworks whose mean estimate is below the third quartile). This second group encompasses 407 lots. Models 5 and 6 in Table 6 (Appendix 2) relate to this second set of observations. Model 5 (*i.e.* aggressiveness of bids) shows results close to our main regression (Model 1). We note that the positive impact of "IBID_SL" indexes – while still observed at every stage of the auction – has more magnitude at the midpoint of the sale. Last, Model 6 does not confirm our hypotheses on the pace of the auction on this sub-population (no more "IBID_IN" indexes are significant). In other terms, for the cheapest lots, whereas aggressive bids still influence the price (especially when they occur at midpoint), the resulting changes in the pace of the auction no longer matter, probably because duels are less intense for "standard lots".[25]

5.2.2. Role of the sale duration

We focus here on two sub-samples, depending on the total sale duration. The first sub-sample consists of lots that took quite a long time to be sold (*i.e.* the 75% longest auctions), while the other gathers the 75% fastest sales. Table 7 (Appendix 2) provides the corresponding estimates. Model 7 and 8 relate to the longest auctions (402 observations), while Models 9 and 10 correspond to the fastest ones (406 observations).

[25] Another interpretation would be that slowdowns during the auction exert no impact on the hammer price, as predicted by hypotheses (H4b) and (H6b).

On all models, most of our hypotheses still prevail. Namely, we confirm that the final price of an auction is boosted by: *i)* early motivation among bidders, (H1a), *ii)* primary arousals generating information on common value (H3a), *iii)* late motivation through final duels (H5a). Let us focus first on punctual aggressiveness (cf. "IBID_SL" indexes in models 7 and 9). We observe that the boosting influence of aggressive bidding concentrates on the two extreme moments (*i.e.* start, end) of the longest auctions. Here, the way long auctions begin / terminate is of upmost importance, as extended time allow strategies to evolve and information to accumulate throughout the sale. At the opposite, such positive influence restricts to the early and middle stages of the fastest auctions, suggesting their outcome mostly depends on what happens at first. Now turning to the auction pace (cf. "IBID_IN" indexes), models 8 and 10 confirm the negative influence on price of $IBID\_IN_{(E)}$ index: *i.e.* whatever the duration, late catch-up effects (cf. prevalence of final duels) positively impact the auction outcome. The magnitude of such influence is stronger for the fastest auctions (-24% against -14%), reflecting the willingness of bidders to terminate rapidly the sale, which we interpret as a sign of strong motivation.

6. Conclusion

This paper investigates whether and how the bid dynamics influence the auction outcome, *i.e.* the final price. While the traditional auction theory assumes stable bidder valuations fixed ahead of the on-sale date, different empirical studies provide evidence suggesting that bidders adjust their reserves over the course of the auction. If bidders' reserves can be considered as "fuzzy", then bidders have a rationale to adopt bidding strategies in order to influence the auction outcome. Yet, these strategies are likely to have a different impact depending on the stage of the auction (beginning, middle, or end of the auction) as the auction context changes. As the sequence of bids reflects bidders' strategies, we explore such bid dynamics at the different phases of the auction and their impact on the hammer price. Using a unique hand-collected database of 547 lots auctioned live, we specifically focus on the degree of aggressiveness of bids as well as on the pace of the auction and we analyze how they can affect the pricing outcome.

We find that strategic behaviors of bidders exist and affect the final price, corroborating the stream of work pointing out that bid dynamics are not neutral with regard to the auction's outcome. According to our theoretical framework, this finding confirms the importance of fuzzy reserves that give bidders incentives to carefully think how they will (re)bid. We show that

aggressive bidding has a significant and positive impact on the hammer price throughout the auction process, but this impact is the strongest at the beginning of the auction. This strategy is followed by bidders who are highly motivated by the prospect of winning the lot and who do not hunt for a bargain. At the end, final duels between motivated bidders may generate a despondency effect amongst bidders, for whom time is too short to readjust their reserves, which attenuates the positive impact of aggressiveness on final price. The motivation effect finally appears to be the strongest effect affecting final prices. Next, we also find that the pace of the auction, resulting from the succession of bids, influences the hammer price. Initial arousals, revealed by acceleration at the beginning of the auction and which may be interpreted by bidders as signals of strong interest towards the lot (*i.e.* they update the common-value component of their valuation), boost the price. Moreover, late catch-up effects, which follow earlier slowdowns and which are characterized by final duels with aggressive offers, contribute significantly and positively to prices. To conclude, motivation effects – coming from bidders whose priority is to win the auction at the expense of their surplus– seem to be the strongest ones compared to other effects such as despondency and inclusiveness.

The results of this research have implications for auction houses and bidders. Regarding the auctioneer who aims at maximising revenues, (s)he can use strategies to spur initial arousals and ultimate duels. He can encourage bidders to start bidding early and has strong incentives to report the bids (s)he sees in the room/at the phone/on the Internet as fast as possible to emphasize the aggressiveness of bids. When conducting a final acceleration of the auction, the auctioneer could emphasize this duel by threatening to close the auction if a bidder starts to slowdown the speed of the auction. With respect to bidders, they should be aware that the more aggressive they bid, the more the final price to acquire the good is likely to rise since bidders are likely to increase their reserves because of arousal effects and of reassessment of the common value component.

An avenue for further research would be to follow bidders over the course of live auctions in order to analyze their individual bidding behaviors. Further research may also investigate the fuzzy reserve functions of individuals, exploring for example what are the individual characteristics that influence this function or if the auction channel (from the room, phone, purchase order or Internet) has an influence. Another promising avenue for research lies in the investigation of other live auction markets to see if the effects of the bid dynamics on the final price at the three stages of the auction generalize across different kinds of goods.

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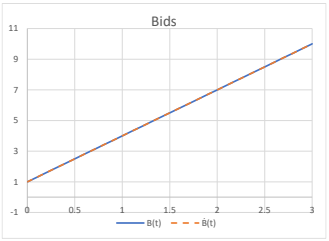
Appendix

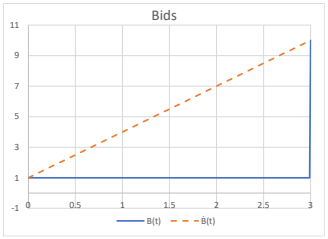
Appendix 1. Simulations

We simulate here how our indexes behave depending on various (fictive) bid dynamics. Nine scenarios (Scen#0 to Scen#9) are considered. For simplification purpose, we consider a continuum of bids B(t), each being made at (continuous) time (t). The overall auction time is set to t(N)=3 (seconds). The plain line refers to the actual bids B(t), while the dashed line links together the benchmarks bids Ḃ(t) that follow the neutral auction path. Scen#0 is a benchmark: all auctions align to the neutral auction path. Scen#1 to Scen#4 display various bid dynamics showing no inflexion during the sale, from the most convex (Scen#1) to the most concave ones (Scen#4). Scen#5 to Scen#8 illustrate dynamics that are more complex: S-shaped curves (Scen#5 and #6) and inverse S-shaped curves (Scen#7 and #8).

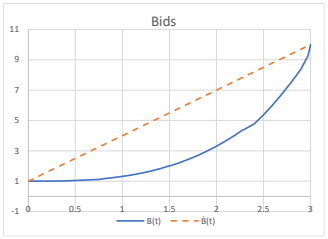
Scen#0 (benchmark)



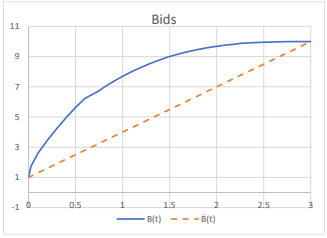
Scen#1



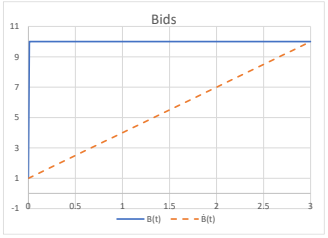
Scen#2



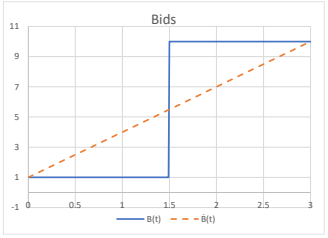
Scen#3



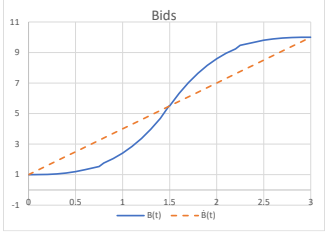
Scen#4



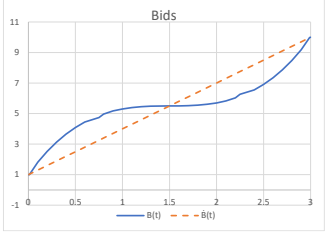
Scen#5



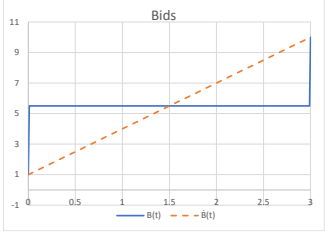
Scen#6



Scen#7

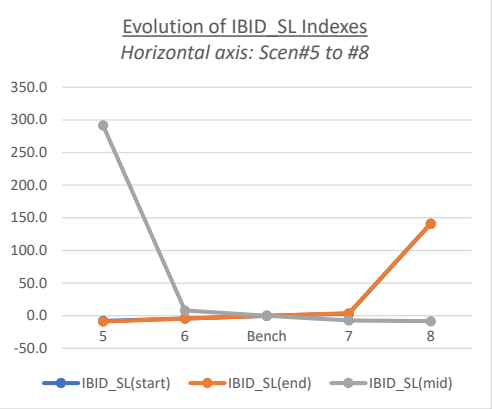


Scen#8

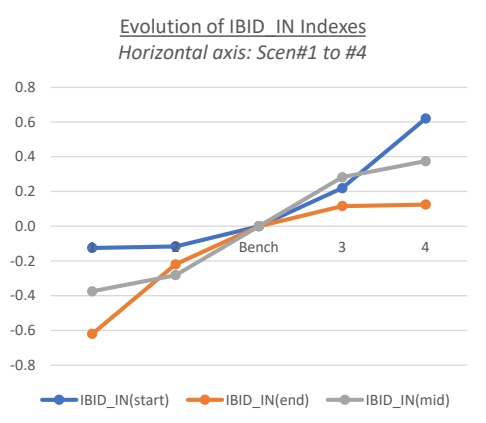


Evolution of index IBID_SL (Scen#1 to #4)

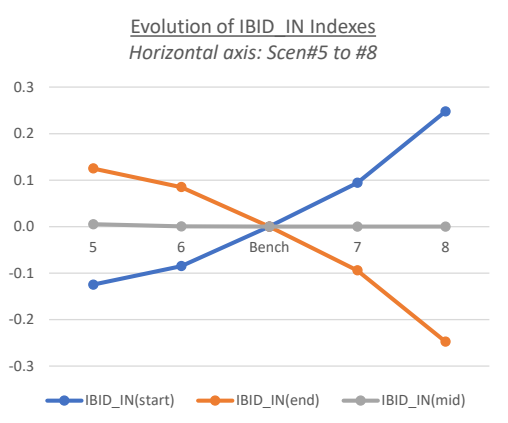
Evolution of index IBID_SL (Scen#5 to #8)



Evolution of index IBID_IN (Scen#1 to #4)



Evolution of index IBID_IN (Scen#5 to #8)



Appendix 2. Robustness checks: estimates

Appendix 2.A. Sub-samples: 75% highest/lowest mean estimated lots

TABLE 6

Robustness check (OLS): Dependent var.: hammer price (subsamples: N=403 ▪ N=407)

Variables		Model 3	Model 4	Model 5	Model 6
IBID_SL(START)		0.012 ***		0.013 **	
IBID_SL(MIDDLE)		0.014		0.028 **	
IBID_SL(END)		0.008		0.013 *	
IBID_IN(START)			0.091		0.035
IBID_IN(MIDDLE)			0.005		0.015
IBID_IN(END)			-0.099 *		-0.067
Control variables related to the sale context					
Christies (0/1)		1.005 ***	0.999 ***	1.245 ***	1.269 ***
Other sales		-0.457 ***	-0.470 ***	-0.626 ***	-0.658 ***
Description time		0.049 ***	0.051 ***	0.019	0.020
Mean time between bids		0.014 **	0.013 **	0.025 ***	0.024 ***
Positive comment		0.237 **	0.199 *	0.375 ***	0.356 ***
Lot order (% of total number of lots)		0.186	0.159	0.164	0.128
Number lots author		0.309 ***	0.308 ***	0.251 ***	0.299 ***
Control variables related to the artist and lot					
Artist's Award (0/1)		0.434 ***	0.463 ***	0.756 ***	0.763 ***
Death (0/1)		0.143	0.164	-0.130	-0.132
Number of publications		0.390 ***	0.409 ***	0.303 ***	0.299 ***
Signature (0/1)		0.050	0.056	0.132	0.142
Size (m2)		0.263 ***	0.281 ***	0.213 ***	0.229 ***
Condition (0/1)		-0.196	-0.220	-0.183	-0.202
Type (0/1):	Coverpage	0.510 ***	0.507 ***	0.476 ***	0.495 ***
	Illustration	0.408 ***	0.456 ***	0.395 ***	0.409 ***
Medium (0/1):	Paint	0.190 **	0.208 **	0.279 ***	0.282 ***
	Pencil	0.190 *	0.199 *	0.095	0.102
	Feltpen	0.237	0.231	0.229	0.190
	Pasting/mixed medium	0.130	0.146	-0.075	-0.081
Subject matter (0/1)	Action	0.146	0.142	0.172	0.194 *
	Ads	0.248	0.209	0.247	0.254
	Adventure/suspens	0.011	-0.013	0.206 *	0.197 *
	Archetypes	0.167	0.176 *	0.079	0.098
	Arts	0.493 ***	0.514 ***	0.711 ***	0.800 ***
	Death	0.173	0.108	0.009	-0.055
	Erotism	0.046	0.055	-0.172	-0.139
	Fantasy/Magic	0.139	0.101	0.110	0.051
	Genre	0.251 **	0.232 **	0.308 ***	0.311 ***
	Historical context	0.230 *	0.215	0.089	0.085
	Homage	0.345 *	0.309	0.213	0.219
	Humor	0.043	0.042	0.048	0.059
	Interaction	-0.072	-0.070	-0.025	-0.007
	Landscape	0.101	0.090	0.241 **	0.246 **
	Love	0.307 *	0.299 *	0.185	0.188
	Portrait	0.258 **	0.243 *	0.208	0.170
	Science-fiction/high-tech	-0.247 *	-0.246 *	-0.221	-0.193
	War/violence	0.031	0.041	-0.025	-0.026
Constant		6.273 ***	6.380 ***	5.805 ***	5.901 ***
F		13.79	13.4	19.1	18.15
R^2 / Adjusted R^2		0.604 / 0.560	0.597 / 0.552	0.676 / 0.641	0.665 / 0.628

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

Appendix 2.B. Sub-samples: 75% longest/fastest auctions

TABLE 7

Robustness check (OLS): Dependent var.: hammer price (subsamples: N=402 ▪ N=406)

Variables		Model 7	Model 8	Model 9	Model 10
IBID_SL(START)		0.018 ***		0.019 ***	
IBID_SL(MIDDLE)		0.016		0.023 *	
IBID_SL(END)		0.025 ***		0.009	
IBID_IN(START)			0.089		0.223 **
IBID_IN(MIDDLE)			0.021		0.044
IBID_IN(END)			-0.141 **		-0.236 ***
Control variables related to the sale context					
Christies (0/1)		1.362 ***	1.350 ***	1.548 ***	1.598 ***
Other sales		-0.675 ***	-0.689 ***	-0.734 ***	-0.755 ***
Description time		0.042 ***	0.045 ***	0.016	0.014
Mean time between bids		0.014 **	0.013 *	0.012	0.009
Positive comment		0.354 ***	0.301 **	0.414 ***	0.386 ***
Lot order (% of total number of lots)		0.154	0.124	0.184	0.180
Number lots author		0.253 ***	0.262 ***	0.307 ***	0.316 ***
Control variables related to the artist and lot					
Artist's Award (0/1)		0.699 ***	0.758 ***	0.765 ***	0.804 ***
Death (0/1)		-0.074	-0.064	-0.108	-0.080
Number of publications		0.470 ***	0.497 ***	0.412 ***	0.415 ***
Signature (0/1)		-0.034	-0.034	0.035	0.030
Size (m2)		0.312 ***	0.352 ***	0.343 ***	0.376 ***
Condition (0/1)		-0.048	-0.094	-0.131	-0.137
Type (0/1):	Coverpage	0.518 ***	0.521 ***	0.762 ***	0.789 ***
	Illustration	0.605 ***	0.685 ***	0.671 ***	0.720 ***
Medium (0/1):	Paint	0.218 **	0.256 **	0.183	0.177
	Pencil	0.284 **	0.306 **	0.267 **	0.302 **
	Feltpen	0.184	0.207	0.459 **	0.387
	Pasting/mixed medium	0.354	0.421 *	-0.064	0.014
Subject matter (0/1)	Action	0.232 *	0.249 **	0.159	0.128
	Ads	0.243	0.207	0.015	0.003
	Adventure/suspens	0.026	0.027	0.216 *	0.170
	Archetypes	0.196 *	0.214 *	-0.025	-0.054
	Arts	0.588 ***	0.625 ***	0.592 **	0.669 **
	Death	0.084	-0.015	0.385	0.323
	Erotism	-0.028	-0.017	-0.191	-0.188
	Fantasy/Magic	0.195	0.151	0.067	0.001
	Genre	0.390 ***	0.354 ***	0.337 ***	0.283 **
	Historical context	0.287 *	0.273 *	0.146	0.167
	Homage	0.220	0.130	0.142	0.103
	Humor	0.167	0.188	0.112	0.108
	Interaction	-0.068	-0.052	-0.003	-0.004
	Landscape	0.166	0.138	0.095	0.061
	Love	0.382 *	0.390 *	0.241	0.155
	Portrait	0.197	0.183	0.285 *	0.237
	Science-fiction/high-tech	-0.141	-0.164	-0.375 **	-0.362 **
	War/violence	-0.067	-0.071	-0.118	-0.123
Constant		5.970 ***	6.123 ***	6.022 ***	6.217 ***
F		24.41	23.05	23.37	22.88
R^2 / Adjusted R^2		0.730 / 0.700	0.719 / 0.688	0.719 / 0.688	0.715 / 0.684

***Statistically significant at 1% level, **Statistically significant at 5% level, *Statistically significant at 10% level

Conclusion

This dissertation studies the art market, an important market which is expected to further expand. This work of research provides a better understanding of the behavior of different market outcomes with a focus on auctions. It sheds light on various determinants of art prices but also of the sale probability and of the difference observed between the pre-sale estimated price and the realized price. This work contributes to the marketing and economics literature by bringing new datasets, original methodologies and empirical contributions.

Chapter 1 analyzes the impact of vertical differentiation (quality related) factors and horizontal differentiation (tastes related) factors on the probability of sale and the final purchase price. We use a unique hand-collected database of 1101 auctioned artworks and we propose Tobit 2 models that correct the selection bias commonly found in previous studies. We show that vertical differentiation variables (e.g. artist's reputation, artist's role, artist's recognition, artworks' commercial and critical successes, number of heroes appearing on a page) have generally no impact on the probability of sale, but all of them affect prices positively. As for horizontal differentiation, we provide evidence that color, composition and style play a role in explaining the probability that an artwork will sell in auction and – for specific types of comic art – the sale price too. Our contribution is threefold. First, we propose an original set of variables accounting for vertical differentiation, which was missing in the literature, and use it to analyze the influence of quality on sale rates and on art prices. Second, we appraise more precisely the diversity of artworks traded on the art market by expanding the set of variables commonly used by the literature to describe horizontal differentiation (adding characteristics such as color, composition, and style). Third, we explore a new art market: comic auctions, where the traded goods have a noteworthy hybrid nature: these are genuine artworks and at the same time commercial goods. We show that despite some intrinsic specificities, the comic art market shares many similarities with traditional painting markets.

Chapter 2 investigates whether subjective perceptions – and more specifically consensus on subjective judgements – have explanatory power in determining art prices. We build a questionnaire in order to measure subjective perceptions of two different social groups. We assess two subjective perceptions: the liking and emotional perceptions elicited by art exposure. Then, we distinguish a group of insiders (art collectors) and a group of outsiders (art-

naïve university students) with a total of 338 participants. We construct an original index that combines valence (*i.e.* the positivity or negativity) and intensity of the consensus of subjective liking and emotional judgments made by individuals. We focus on the comic art market (124 auctioned original comic artworks) since unlike other art markets, an accessible online forum allows to reach a great number of collectors. Our results show that liking and emotional consensus affect prices differently depending on the social group from which they are issued. More precisely, we observe that artworks generally achieve higher prices when they are consensually liked by collectors or are eliciting positive emotion to them. Moreover, we unexpectedly find that what is consensually liked by or evokes positive emotions to novice subjects generally achieve lower prices at auction. Delving deeper in the relation between artworks' characteristics and subjective perceptions, we report a difference between the artwork's characteristics that influence liking and emotional judgements of collectors and non-collectors, which explains the pattern of our main finding. This chapter contributes to the literature in two principal ways. First, we contribute to the literature by considering for the first time human subjective judgment of artworks and consensus in art tastes and emotions in artworks pricing models, while the literature have exclusively considered objective factors. More specifically, we investigate the influence of (dis)liking and emotional consensus of different social groups on art prices at auction, an unexplored direction of causality. Second, this research is the first to study art perceptions in an actual group of market insiders in the economic sense of the term, since studies on art evaluations consider groups of art experts –in contrast to naïve subjects – such as art students or individuals having an artistic background. To conclude, this study allows a better understanding of human perception, shared preferences and the interaction between aesthetics judgments and prices.

Chapter 3 examines the impacts of marketing strategies implemented by auctions houses and human auctioneers on sale rates, on prices realized at auction, but also on the difference between pre-sale estimated prices and realized prices. We use a unique database which includes 1101 prices of artworks presented for sale between March 2017 and May 2018 by six different auction houses and a number of variables accounting for the different aspects of auction houses' organizational and promotional work and of auctioneers' behavior. We gather these data from auction catalogues and video recordings of auction sales. We find that many organizational factors impact the sale probability and prices, such as the level of competition with similar sales, the number of lots from the same artist, the presence of a top-up or the decision of selling lots including multiple items. Moreover, we show that all variables

reflecting the promotional work carried out by auction houses play a significant and positive role in determining prices, while the presence of a written positive comment ahead of the sale has in addition a highly significant and positive influence upon the probability of sale and the price-estimate ratio. Last, our results reveal that the impact of auctioneers' behavior seems to be decisive: the usage of humor by the auctioneer has a positive effect on sale rates and auction prices, and the price-estimate ratio is mostly determined by the behavior of the auctioneer. Our contributions are threefold. First, we provide a range of variables accounting for the marketing efforts of auction houses regarding the organization of sales and the promotion of the lots for sale in order to test their effects on market outcomes. Second, we proceed to an analysis of the auctioneer's set of interventions when conducting outcry auctions and relate them to auction outcomes. Third, in addition to the probability of sale and prices, we investigate determinants of the price-estimate ratio. The findings of this study yield important managerial insights for marketers. The auction house effects detected here reveal the economic significance of auction houses strategies and provide some guidance as to the organization of auction sales and the promotion of lots, in order to maximize revenues. What is more, we provide clear evidence of the impact of some auctioneer's actions – especially the use of humor – on bidders' behaviors over the course of the auction sale, which in turn affect final outcomes. This observation can be used in the recruitment process of auctioneers and demonstrates the usefulness of humor training programs for auctioneers. In conclusion, this research brings a more comprehensive understanding of bidders' behavior, the mechanisms through which auction houses and auctioneers affect outcomes, and the functioning of real-world auction markets.

Chapter 4 explores whether and how the bid dynamics influence final auction prices. Specifically, we study the degree of aggressiveness of bids and the pace of the auction at the different phases of the auction. We construct a database of 547 art lots auctioned in live English auctions with a professional auctioneer, thanks to video recordings of auction sales. We find that bid dynamics are not neutral towards final auction prices. According to our theoretical framework, this result confirms the importance of bidders' "fuzzy" reserve prices which gives incentives to bidders to engage in strategic behaviors. We show that the auction price benefits from the presence of "motivated" bidders – who are bidders interested in winning the auction more than preserving their surplus and thus bid aggressively (high and fast) – especially at the beginning and end of the auction. This positive impact is yet attenuated at the end of the auction, probably because of some despondency effect amongst bidders when final duels occur. Furthermore, the pace of the auction also has an influence on auction prices. Early arousals,

which can be interpreted as information on the common value component of the item, increase the price. Also, final accelerations of the auction, which reflect ultimate duels between bidders, substantially affect the hammer price. The contribution of this chapter is twofold. First, we propose a conceptual framework of bidders' fuzzy reserve prices. Second, this research contributes to a better understanding of bid dynamics and bidding behaviors by offering a readily understandable insight into bid dynamics and their impact. We also provide the analysis of a case of live auctions in brick-and-mortar auction houses with a human auctioneer conducting the sale, as well as of auctions of hedonic goods, which have received few attention up to now. The results of this study have implications for auction houses and bidders. The auctioneer can use strategies to encourage initial arousals, duels and aggressiveness of bids. Bidders should be aware that the more aggressive they bid, the more the final price to obtain the lot is likely to be high.

Finally, we address some limitations of this dissertation which open promising avenues for future research. First, we used the hedonic price approach for these different chapters, but the realized auction prices are the result of bid and ask valuations (*i.e.* the valuations of both the seller and the bidders), so that we cannot ascertain sellers' or bidders' valuations of characteristics. Additional data on sellers' and bidders' characteristics would allow to understand individual preferences and behaviors. However, the accessibility of these data remains problematic since auction houses respect the anonymity of bidders and sellers. Auction houses are indeed prohibited to reveal the name of the seller or the buyer of a lot, unless explicit agreement for the sale of a collection for instance. Second, we use cross-sectional data over a one-year period, *i)* in order to achieve a high degree of precision of the variables reflecting the effects we wanted to test, which requires a manual data collection and therefore results in a lower number of observations than in electronic databases, *ii)* because the original comic art market is young and the information was less abundant and less reliable in the first catalogues of auction sales. Further research could observe the effects of the determinants of art prices we highlighted on a longer period. Third, we focus on the comic art market to conduct our research, but it would also be interesting to explore other auction markets for auction house, auctioneer and sequence of bids effects, or other art markets, especially new ones such as the street art market, as previous studies analyzing art price determinants have often concentrated on paintings. Fourth, the role of various other characteristics in explaining auction outcomes can be examined such as the auctioneer's gesture and bodily conduct, features of pre-sale exhibitions or different measures of subjective perception. Fifth, future inquiry may concern

functional data modelling which would allow to refine the analysis of bid dynamics. Lastly, the original datasets and methodologies used in this dissertation can be exploited for future research.

Résumé de thèse

Le commerce d'œuvres d'art remonte *a minima* au temps de l'Empire romain, comme en témoignent la découverte de restes de navires chargés de sculptures grecques près du littoral italien (Chanel et al. 1994). Depuis la fin de la Seconde Guerre mondiale, l'achat et la vente d'art sont devenus de plus en plus populaires (Frey et Pommerehne 1989), de sorte qu'au cours des dernières décennies, le marché de l'art a connu une croissance spectaculaire, avec des hausses remarquables à la fin des années 1980 et dans les années 2000. Les ventes ont augmenté de plus de 575 % entre 1991 et 2007 (TEFAF 2012) et ont plus que doublé sur la décennie 2004-2014 (Art Basel et UBS 2019). En 2018, le marché mondial de l'art — qui comprend les ventes des marchands d'art et les ventes aux enchères — atteignait 67,4 milliards de dollars de ventes, soit une augmentation de 6 % par rapport à l'année précédente, et enregistrait un nombre de transactions estimé à 39,8 millions, selon le rapport d'Art Basel et UBS de 2019 sur le marché mondial de l'art. En outre, l'art représente aujourd'hui une part non-négligeable de la richesse totale des ménages. Selon une étude de Barclays (2012), les particuliers fortunés[1] détiennent en moyenne près de 10 % de leur patrimoine dans des œuvres d'art, des bijoux, des antiquités et autres articles de luxe à offre limitée, ce qui correspond à un montant supérieur à 4 000 milliards de dollars en 2012 (Deloitte 2013). Ces chiffres soulignent l'importance quantitative du marché de l'art et ce marché devrait poursuivre son expansion à l'avenir. Le nombre de millionnaires[2] — les collectionneurs d'art faisant généralement partie de cette population — devrait en effet augmenter de 34 % entre 2019 et 2024 (Crédit Suisse 2019). De plus, le rapport *Art and Finance* 2019 de Deloitte, qui met l'accent sur les particuliers très fortunés[3], indique que cette population est désireuse d'accroître ses investissements dans les objets d'art et de collection comme partie intégrante de leur patrimoine — tant pour profiter de ces objets que pour leur valeur financière— et prévoit une augmentation estimée à 55 % de leur patrimoine affecté à l'art et aux biens de collection entre 2018 et 2026.

[1]Les particuliers fortunés sont définis comme des individus dont les actifs de placement représentent au moins 1,5 millions d'USD.
[2]Les millionnaires se réfèrent ici à ceux dont le patrimoine net (actifs financiers et non financiers moins dettes) est supérieur à 1 million de dollars (Credit Suisse's Global Wealth Databooks).
[3] Les particuliers très fortunés sont définis comme des individus dont les actifs de placement représentent plus de 30 millions d'USD.

Toutefois, les objets d'art sont des biens économiques extraordinaires qui ne sont pas faciles à évaluer. Les déterminants de la valeur de l'œuvre d'art diffèrent de ceux des actions et autres actifs financiers, car les œuvres d'art ne sont pas des instruments financiers purs, mais aussi des biens de consommation. D'une part, les œuvres d'art peuvent effectivement fournir des services financiers à leurs propriétaires grâce à leur potentiel d'appréciation du prix, étant donné que les œuvres d'art sont des biens durables qui peuvent être revendus. D'autre part, la possession d'œuvres d'art offre en même temps des services de consommation, grâce à un dividende esthétique fourni par la jouissance des qualités intrinsèques des œuvres d'art et à un bénéfice social découlant du prestige et de la distinction sociale que confère la possession d'un chef-d'œuvre[4]. En outre, contrairement aux actifs financiers, les objets d'art sont en principe des œuvres d'art uniques et originales — un cas extrême de biens hétérogènes — de sorte que chaque œuvre d'art est évaluée différemment par tous les futurs propriétaires potentiels en fonction des gains de consommation qu'ils tireraient de l'œuvre d'art. C'est ce flux de gains pécuniaires et non-pécuniaires générés par les œuvres d'art qui rend difficile l'évaluation de la valeur des œuvres d'art.

De plus, les marchés de l'art diffèrent considérablement des marchés financiers. L'offre sur le marché de l'art ne peut être augmentée lorsque l'on considère les œuvres d'artistes décédés et elle est limitée lorsque l'on considère la durée de vie finie des artistes vivants. Le marché est également fortement segmenté : la moitié des ventes d'œuvres d'art (en valeur) se fait aux enchères (avec des variations marginales d'une année à l'autre) et l'autre moitié est réalisée par des marchands tels que des galeries, des magasins, des intermédiaires privés, des marchands indépendants et des plateformes en ligne (Art Basel et UBS 2019). En outre, les coûts de transaction sont élevés et des délais importants sont nécessaires pour la vente, ce qui rend les œuvres d'art peu liquides. Enfin, la possession d'œuvres d'art comporte un certain niveau de risque en raison d'éventuels dommages physiques, de vols, de contrefaçons et de réattributions, tandis que l'assurance et la restauration sont coûteuses. Ainsi, les prix de l'art dépendent d'une combinaison de facteurs spécifiques, largement différents de ceux d'autres actifs ou biens.

L'objectif de cette thèse est d'explorer les déterminants des prix de l'art, avec un focus sur les enchères. Les prix de vente aux enchères sont en effet accessibles au public et fiables, contrairement aux prix des marchands ou des ventes de gré-à-gré, qui sont difficiles à

[4] Le journal *The Economist* écrit en 2006 : « Quel est l'intérêt d'être riche si vous ne pouvez pas boire les vins les plus fins tout en contemplant les œuvres d'art les plus célèbres au monde sur les murs de votre penthouse ? »

obtenir ou incertains. De plus, les prix des œuvres vendues aux enchères influencent de manière substantielle le marché de l'art, car les galeries, les marchands et les collectionneurs les considèrent comme des prix indicatifs (Frey et Pommerehne 1989). Cette recherche repose sur une approche interdisciplinaire, contribuant à la recherche en économie ainsi qu'en marketing.

Au cours des dernières décennies, les chercheurs se sont montrés de plus en plus intéressés par les ventes aux enchères et les marchés de l'art. **Les études économiques et financières** se sont concentrées principalement sur l'art en tant qu'investissement, c'est-à-dire aux taux de rendement sur les marchés de l'art, à la comparaison entre ces rendements et ceux d'autres investissements tels que les actions et les obligations, et à la question de savoir s'il peut être pertinent d'inclure des investissements dans l'art dans un portefeuille diversifié. Anderson (1974), Baumol (1986), Frey et Pommerehne (1989), Goetzmann (1993), Renneboog et Van Houtte (2002) montrent que les investissements dans l'art sont moins intéressants que les investissements dans des actifs financiers traditionnels — tels que les actions, les obligations ou les bons du Trésor — en termes de risques et de rendement, de sorte qu'acquérir des œuvres ne semble rationnel que si elles détiennent une importante valeur de consommation pour son propriétaire afin de compenser la faible rémunération financière. En revanche, d'autres études ont conclu que sur certains segments du marché de l'art et pendant certaines périodes, l'art peut offrir des rendements plus élevés que les obligations, les bons du Trésor et l'or, parfois même comparables aux rendements des actions (Buelens et Ginsburgh 1993, Chanel et al. 1994, Mei et Moses 2002). Des études plus récentes ont principalement montré que l'art peut apporter des avantages en matière de diversification du portefeuille d'un investisseur et peut donc jouer un rôle en tant qu'investissement alternatif (Mei et Moses 2002, Hodgson et Vorkink 2004, Pesando et Shum 2008, Korteweg et al. 2016).

Afin d'examiner les prix et les rendements sur le marché de l'art, un indice des prix est généralement construit en utilisant soit la régression par ventes répétées, soit la régression hédonique, les deux principales méthodes économétriques utilisées pour les études sur le marché de l'art.

L'approche de la régression par ventes répétées, utilisée par Baumol (1986), Goetzmann (1993), Pesando (1993), Mei et Moses (2002), Pesando et Shum (2008), se fonde sur les prix des œuvres d'art qui ont été vendues deux fois ou plus au cours d'une certaine période afin d'estimer les fluctuations de la valeur d'un actif moyen (c'est-à-dire une œuvre d'art représentative) sur la période définie. L'application de cette méthode pour estimer un indice de prix pour l'art offre l'avantage de contrôler explicitement pour le caractère unique de chaque

œuvre d'art, mais présente des inconvénients évidents, tels que le biais de sélection résultant de la prise en compte des ventes répétées uniquement, tandis qu'un nombre limité de reventes peut empêcher la constitution d'un indice de prix robuste.

La deuxième approche — la régression hédonique — largement adoptée par la littérature, quelques exemples étant les études de Chanel et al. (1996), Higgs et Worthington (2005), Kraeussl and Logher (2010) et Renneboog et Spaenjers (2013), utilise toutes les données de transaction disponibles et consiste à régresser le prix de chaque œuvre d'art sur certaines de ses caractéristiques. Les coefficients estimés des caractéristiques observables peuvent être interprétés comme les «prix implicites» de chacun de ces attributs. Cette approche permet de déterminer les évaluations relatives des caractéristiques par les consommateurs et d'identifier les déterminants du prix, c'est-à-dire les variables expliquant les prix de l'art. Lorsque les prix sont régressés non seulement sur un ensemble de caractéristiques mais aussi sur une ou plusieurs variables temporelles, un indice des prix peut être construit. Les avantages de l'utilisation d'une régression hédonique sont que toutes les transactions peuvent être incluses dans l'estimation et que les déterminants des prix peuvent être identifiés. Mais l'un de ses principaux inconvénients réside dans le fait que la régression peut être biaisée en fonction des caractéristiques considérées pour décrire les biens et pour contrôler les différences de qualité entre les œuvres (omission de caractéristiques importantes ou choix inadéquat de caractéristiques).

Comme la plupart des études empiriques reposent sur des données d'enchères, les caractéristiques incluses dans la régression hédonique sont généralement celles mises à disposition par les maisons de vente aux enchères, telles que le nom de l'artiste, le type d'œuvre, la taille, le support, le sujet et certaines caractéristiques de vente telles que la maison de vente aux enchères, le lieu, l'année et le mois de la vente. Toutefois, le nombre de caractéristiques considérées reste relativement limité et se concentre essentiellement sur quelques caractéristiques de l'artiste, les caractéristiques physiques des œuvres d'art et les aspects liés à la vente. L'identification de nouveaux déterminants des prix de l'art reste modérée dans la littérature, certainement dû au fait que la collecte d'informations sur ce marché est longue et difficile. Les quelques études qui ont contribué à élargir l'ensemble des variables explicatives des prix de l'art se sont concentrées sur la mesure de la réputation, de la certitude de l'attribution ou de la provenance de l'œuvre (Campos et Barbosa 2008, Marinelli et Palomba 2011, Renneboog et Spaenjers 2013, entre autres), sur l'effet d'ancrage (Beggs et Graddy 2009, Graddy et al. 2015), sur les facteurs macroéconomiques (Goetzmann et al. 2011) et sur les effets de mode et du « sentiment » sur le marché de l'art (Pénasse et al. 2014).

Il convient de mentionner ici qu'une particularité du marché de l'art vendu aux enchères est qu'environ un tiers des œuvres d'art présentées à la vente demeurent invendues (Artprice 2017), ce qui se produit lorsque l'enchère la plus élevée n'atteint pas le prix de réserve du vendeur. La plupart des études précédentes excluent les lots invendus de leur échantillon. Ce biais de sélection communément constaté dans la littérature sur les prix de l'art aux enchères a été mis en évidence par quelques études (comme celles de Collins *et al.* 2009, Marinelli et Palomba 2011, Farrell et al. 2018) qui ont par conséquent examiné non seulement les prix des enchères, mais aussi la probabilité de la vente des œuvres d'art.

Dans la discipline du marketing, différents travaux analysent l'incidence des pratiques des maisons de vente aux enchères et des commissaires-priseurs sur les prix aux enchères. Premièrement, certaines études révèlent un impact statistiquement significatif des pénalités pour non-vente (Greenleaf et Sinha 1996), des frais et commissions (Yao et Mela 2008) et des primes acheteurs (Morwitz et al. 1998) appliqués par les maisons de vente aux enchères sur le prix de vente. Deuxièmement, en ce qui concerne les pratiques autorisées ou non par les adjudicateurs au cours de l'enchère, He et Popkowski Leszczyc (2013) trouvent que permettre aux enchérisseurs d'enchérir au-delà de l'incrément a une influence positive sur les prix finaux. Enfin, concernant les stratégies de commercialisation des maisons de vente aux enchères, D'Souza et Prentice (2002) et Ducarroz (2016) entre autres montrent que certains efforts promotionnels des maisons de vente aux enchères ont un effet positif sur le prix final des enchères.

Dans ce travail de thèse, nous proposons d'approfondir les facteurs déterminant les prix de l'art ainsi que la probabilité de vente des œuvres d'art. Nous nous appuyons sur deux disciplines, l'économie et le marketing, qui enrichissent toutes deux notre compréhension des prix de l'art aux enchères. Ce travail se concentre sur quatre axes de recherche ayant reçus peu d'attention dans la littérature. Premièrement, nous examinons comment la différenciation verticale (liée à la qualité) et la différenciation horizontale (liée aux goûts) affectent la probabilité de vente et le prix des œuvres d'art mises aux enchères (chapitre 1). Nous proposons un ensemble original de variables tenant compte de la différenciation verticale, particulièrement importante puisque les marchés de l'art souffrent d'incertitudes sur la qualité et d'asymétries d'information. Pour ce faire, nous explorons un jeune marché de l'art où les biens échangés ont une nature hybride remarquable : le marché des originaux de bande dessinée. Deuxièmement, nous examinons l'influence des perceptions subjectives sur les prix de l'art, et si le fait que les

perceptions soient partagées peut expliquer une partie de la valeur de l'art (chapitre 2). Grâce à une enquête, nous testons si et comment le consensus sur les perceptions subjectives, et plus particulièrement le consensus sur l'appréciation et les émotions, des initiés (collectionneurs d'art) et des individus lambda (non-collectionneurs) se reflètent dans le prix des œuvres d'art aux enchères. Troisièmement, nous examinons de manière empirique l'influence des stratégies mises en œuvre par les maisons de vente aux enchères et les commissaires-priseurs[5] sur les taux de vente, sur les prix pratiqués lors des enchères, mais aussi sur les différences entre le prix des enchères et le prix estimé avant la vente (chapitre 3). En utilisant des enregistrements vidéo et une base de données unique, nous analysons l'effet du travail organisationnel et promotionnel des maisons de vente aux enchères, ainsi que le comportement des commissaires-priseurs. Quatrièmement, nous nous concentrons sur la dynamique des enchères et son impact sur le prix final (chapitre 4). En utilisant des données originales de dynamique d'enchères d'œuvres d'art, nous examinons si le degré d'agressivité de l'enchère et les changements de rythme (accélération et ralentissement) dans les différentes phases du processus d'enchères sont neutres vis-à-vis du prix final ou si au contraire ils influencent le résultat des enchères.

Pour ce travail de recherche, nous construisons **quatre bases de données originales**. Elles sont basées sur les mêmes ventes aux enchères d'originaux de bande dessinée. Nous nous concentrons sur le marché des originaux de bande dessinée, car il s'agit d'un marché qui a fait l'objet de très peu d'études et qui présente des caractéristiques remarquables permettant d'explorer de nombreuses questions.

La première base de données, que nous appelons la « base de données différenciation » utilisée pour notre premier chapitre sur la différenciation horizontale et verticale, comprend 1101 observations. Ces observations sont les prix de 1101 d'originaux de bande dessinée mis aux enchères lors de sept ventes (par six maisons de vente différentes étant donné que nous incluons deux ventes réalisées par Christie's) entre mars 2017 et mai 2018 à Paris et à Bruxelles. Elle comprend un ensemble de variables qui décrivent en détail l'œuvre d'art et l'artiste. Les informations permettant de construire ces variables ont été collectées manuellement à partir *i)* de la description du lot dans les catalogues réalisés par les maisons de ventes aux enchères,

[5] Il est courant de trouver dans la littérature le terme « commissaire-priseur » pour désigner le vendeur ou l'agent de vente aux enchères (Hossain et al. 2013). Dans ce chapitre, nous appelons « maison de vente aux enchères » une entreprise qui organise des ventes aux enchères physiques (au moins partiellement) et « commissaire-priseur » le professionnel chargé de la conduite des enchères orales.

ii) des images des lots fournies par les catalogues et analysées à l'aide du logiciel d'imagerie ImageJ©, *iii)* de Bédéthèque©, un site web français spécialisé dans la bande dessinée, et *iv)* du site internet Amazon©. Puis, pour les trois autres bases de données, nous utilisons les mêmes observations (toutes ou en partie). Certaines variables de la « base de données différenciation » décrivant l'œuvre d'art et l'artiste sont systématiquement utilisées dans les autres bases de données.

La deuxième base de données, que nous appelons la «base de données consensus» (utilisée pour le chapitre 2), comprend 124 observations. Ces observations sont les prix de 124 originaux de bande dessinée mis aux enchères par Artcurial en avril 2017. La « base de données consensus » comprend un ensemble de variables liées aux perceptions subjectives de l'art de la bande dessinée par des individus initiés d'une part et étrangers d'autre part au marché des originaux. Ces variables ont été collectées grâce à une enquête que nous avons menée en utilisant le logiciel Limesurvey© sur une population de collectionneurs d'originaux de bande dessinée (représentatif des acteurs du marché) et sur une population de non-collectionneurs (étrangers à ce marché). Les autres variables sur les caractéristiques des artistes et des œuvres proviennent de la « base de données différenciation ».

La troisième base de données, que nous appelons la « base de données intermédiaire de vente » (utilisée au chapitre 3), contient 1101 observations qui correspondent aux prix de vente aux enchères de 1101 originaux de bande dessinée (l'ensemble de l'échantillon de la « base de données différenciation »). Cette base de données comprend un ensemble de variables relatives aux pratiques des maisons de ventes aux enchères et des commissaires-priseurs. Les informations permettant de construire ces variables proviennent *i)* de la description écrite et de l'image du lot dans les catalogues de vente, *ii)* d'enregistrements vidéos de ventes aux enchères retransmises en direct sur la plateforme Drouot Live ou sur les plateformes des maisons de vente aux enchères (pour Artcurial et Christie's), grâce au logiciel ActivePresenter©, et *iii)* des sites internet de maisons de vente aux enchères françaises et belges. Les autres variables sur les caractéristiques des artistes et des œuvres proviennent de la « base de données différenciation ».

La quatrième et dernière base de données, que nous appelons la « base de données dynamique des enchères » (utilisée au chapitre 4), contient des données sur les prix et la dynamique des enchères de 547 originaux de bande dessinée vendus aux enchères. Sur l'ensemble de l'échantillon de la « base de données différenciation », nous sélectionnons les lots vendus pour lesquels nous observons deux enchères ou plus (donc plus d'un enchérisseur). Les données sur la dynamique des offres sont collectées à partir d'enregistrements vidéo des ventes aux enchères retransmises en direct sur la plate-forme Drouot Live ou sur les propres

plateformes des maisons d'enchères, grâce au logiciel ActivePresenter©. Un autre ensemble de variables sur les caractéristiques des œuvres et des artistes provient de la « base de données différenciation ». Un dernier ensemble de variables liées à l'environnement de vente provient de la « base de données intermédiaire de vente ».

Ces travaux de recherche sont organisés en quatre chapitres.

Le **chapitre 1** examine comment la différenciation verticale (liée à la qualité) et horizontale (liée aux goûts) influence *i)* la probabilité de vente et *ii)* le prix final des œuvres d'art mises en vente aux enchères. Les œuvres d'art sont un cas extrême de produits différenciés et présentent un ensemble de caractéristiques impliquant une différenciation horizontale et verticale (Waterson 1989).

La littérature met l'accent sur l'impact des variables de différenciation horizontale sur les prix, telles que la taille, la technique ou le sujet (Anderson 1974, Agnello et Pierce 1996, Higgs et Worthington 2005, Renneboog et Spaenjers 2013, entre autres), délaissant l'analyse de l'influence des variables de différenciation verticale sur les prix, qui tiennent compte de la qualité des œuvres d'art, alors que cette dernière dimension est particulièrement importante sur les marchés de l'art qui souffrent d'incertitudes qualitatives et d'asymétries d'information (Akerlof 1970, Von Ungern-Sternberg et Von Weizsacker 1985, Beckert et Rössel 2013).[6] La source de ce biais observé dans la littérature (*i.e.* la focalisation sur les variables de différenciation horizontale) est double. La prise en compte de la différenciation verticale constitue d'abord un défi empirique sur les segments du marché de l'art couramment analysés et, deuxièmement, elle est compliquée en raison de la description approximative des œuvres d'art dans les bases de données électroniques et les catalogues de vente aux enchères. En prenant en compte ces deux limites, nous analysons dans ce chapitre si les facteurs de différenciation verticale déterminent les prix de l'art. Premièrement, nous nous concentrons sur le marché des originaux de bande dessinée pour lequel des variables de différenciation verticale et horizontale peuvent être clairement distinguées en raison de la nature hybride des biens échangés. En effet, les originaux de bande dessinée sont à la fois des œuvres d'art uniques et des biens commerciaux destinés à être imprimés en grand nombre pour former les albums de bande dessinée. Nous mesurons ainsi des variables de différenciation verticale (la réputation de l'artiste, la reconnaissance de l'artiste par ses pairs, le rôle de l'artiste dans le processus de création, les succès commercial et critique de l'œuvre, le nombre de héros apparaissant sur

[6] Czujack (1997), Onofri (2009) et Marinelli et Palomba (2011) ont proposé deux indicateurs de la qualité des œuvres d'art, mais qui posent des problèmes intrinsèques.

l'œuvre) en plus de variables de différenciation horizontale. Nous incluons des variables de différenciation horizontale communément trouvées dans la littérature mais également de nouvelles variables de différenciation horizontale (liées au style, à la composition et à la couleur de l'œuvre). Deuxièmement, nous avons collecté manuellement nos données en nous basant sur les descriptions et images des catalogues de vente aux enchères recoupées avec des sources externes. Notre base de données rassemble 1101 originaux de bande dessinée mis aux enchères en 2017 et 2018 sur le marché européen des originaux, à savoir le marché franco-belge. Un autre biais couramment constaté dans la littérature est un biais de sélection de l'échantillon : la majorité des études précédentes excluent de leur échantillon les œuvres d'art invendues. Nous estimons des modèles Tobit II permettant d'inclure dans notre échantillon à la fois les lots vendus et invendus, afin d'améliorer la fiabilité de nos régressions et de tester l'influence de nos variables tout au long du processus de vente, c'est-à-dire non seulement sur le prix final, mais aussi sur la probabilité de vente.

Nos résultats montrent qu'aucune variable de différenciation verticale n'influence de manière significative la probabilité de vente. Ce résultat montre qu'en raison de différents traits psychologiques (cupidité, excès de confiance ou excitation face à une augmentation de la qualité), les vendeurs d'originaux surévaluent parfois leur œuvre par rapport aux acheteurs, tandis que l'inverse se produit à d'autres moments. Dans l'ensemble, les surévaluations des uns et des autres (vendeurs et acheteurs) se compensent mutuellement, de sorte qu'en moyenne un changement de qualité n'affecte pas la probabilité de vente. Ce résultat reste valable pour des sous-échantillons plus homogènes, à l'exception de variables de différentiation verticale relatives à l'artiste qui impactent positivement la probabilité de vendre le lot. En revanche, une augmentation de la qualité conduit logiquement à un prix plus élevé : toutes nos variables de différenciation verticale ont une impact très significatif et positif sur le prix des œuvres d'art.

Concernant la différenciation horizontale, nous montrons que certaines caractéristiques des œuvres relevant de la différenciation horizontale ont une influence significative sur les ventes et les prix. Ce résultat suggère que les goûts individuels concernant les attributs physiques et artistiques des œuvres ne se compensent pas toujours : au contraire, les préférences partagées, les tendances et les modes jouent un rôle décisif dans les enchères d'originaux, puisque des goûts partagés par la majorité conduisent à des inclinaisons ou des aversions communes. En outre, en ce qui concerne nos nouvelles variables de différenciation horizontale considérées dans cette analyse, nous constatons que la couleur, la composition et le style influencent de manière significative la probabilité de vente et — pour certains types d'orignaux de bande dessinée — le prix de vente.

Enfin, nous nous interrogeons dans quelle mesure nos résultats pourraient être généralisables à d'autres marchés de l'art et nous constatons que le marché des originaux de bande dessinée présente de nombreuses similitudes avec les marchés traditionnels de la peinture, bien qu'il conserve certaines spécificités intrinsèques.

Notre contribution est triple. Premièrement, en proposant un nouveau cadre d'analyse, cette recherche met en lumière le rôle des variables de différentiation verticale et horizontale tout au long du processus de vente. Deuxièmement, nous apportons un ensemble de variables tenant compte de la différenciation verticale, qui manquait dans la littérature. Nous élargissons également l'ensemble de variables couramment utilisées par la littérature pour décrire la différenciation horizontale (ajout de caractéristiques telles que la couleur, la composition et le style). Troisièmement, nous explorons un nouveau marché de l'art: celui des originaux de bande dessinée, et nous examinons les similarités que ce marché partage avec les marchés traditionnels de la peinture.

Le **chapitre 2** examine de manière empirique le rôle des perceptions subjectives, et en particulier du consensus sur les perceptions subjectives, dans la détermination du prix des œuvres d'art. Les études précédentes se sont concentrées sur des déterminants objectifs des prix de différentes catégories, comme les attributs physiques des œuvres d'art (Higgs et Worthington 2005, Marinelli et Palomba 2011, Ma et al. 2019, entre autres), les variables liées à l'artiste (Ekelund et al. 2000, Campos et Barbosa 2008, Ursprung et Wiermann 2011, entre autres) et les caractéristiques de vente (Beggs et Graddy 1997, Renneboog et Van Houtte 2002, entre autres). Toutefois, il existe également une dimension subjective d'appréciation et d'émotion dans la fonction d'utilité du consommateur d'art et par conséquent dans le prix des œuvres d'art. Ma et al. (2019) ont récemment souligné l'impact des émotions – en particulier l'émotion du plaisir – sur les prix dans une étude économique et expérimentale axée sur la couleur. Et si, comme le supposent Graham et al. (2010), de nombreuses personnes partagent le même jugement subjectif vis-à-vis d'une œuvre, le prix s'en trouve-t-il affecté ? Ou les perceptions subjectives sont-elles uniquement une composante personnelle qui n'affecte que les évaluations et estimations individuelles ? À notre connaissance, il n'existe pas de recherche en marketing ou en économie sur le consensus sur un jugement subjectif dans un contexte d'évaluation du prix de l'art. Ce chapitre a pour objet d'étudier les effets du consensus sur l'appréciation et les émotions au sein de deux groupes sociaux différents (des initiés sur le marché *versus* des personnes étrangères au marché) sur les prix de l'art lors des enchères.

Pour mesurer les perceptions subjectives, nous avons élaboré un questionnaire qui a été envoyé à des collectionneurs (*insiders*) et des étudiants (*outsiders*). Les stimuli consistaient en 124 originaux de bande dessinée vendus par la maison de vente aux enchères Artcurial le 8 avril 2017 à Paris. Nous nous concentrons sur le marché des originaux de bande dessinée, car il s'agit de l'un des rares marchés de l'art pour lequel il existe un forum en ligne relativement accessible qui rassemble de nombreux collectionneurs. Pour chaque œuvre d'art, nous avons mesuré la valence émotionnelle (c'est-à-dire la positivité ou la négativité des émotions) et le degré d'appréciation des participants. Nous avons construit un indice de consensus pour mesurer le degré de consensus sur l'appréciation et l'émotion parmi les individus de chaque groupe. Notre approche explore la relation entre les prix réels des œuvres d'art vendues aux enchères et le consensus sur l'appréciation esthétique et les émotions de novices et d'individus expérimentés en utilisant un modèle des prix hédoniques.

Nos résultats montrent que le consensus sur l'appréciation et les émotions se reflète dans les prix des œuvres vendues aux enchères, mais différemment selon le groupe social dont il émane. Plus précisément, nous observons que les œuvres d'art atteignent des prix significativement plus élevés lorsqu'elles sont appréciées par les collectionneurs ou qu'elles leur procurent des émotions positives. Ce résultat montre que les collectionneurs – des initiés sur le marché de l'art – ont intégré des normes esthétiques communes sur ce qui est considéré comme du « bon art » et que les prix des œuvres sont déterminés en fonction de leur conformité à ces principes partagés et assimilés par les *insiders*. En outre, nous constatons de manière inattendue que les œuvres qui sont appréciées de manière consensuelle ou provoquent des émotions positives aux *outsiders* se vendent en moyenne à des prix plus bas lors des enchères. Il apparait ainsi que les codes esthétiques partagés par les collectionneurs ne se propagent pas aux personnes lambda, qui n'ont pas non plus connaissance des modes qui influencent le marché de l'art. De plus, le jugement sur l'appréciation et les émotions des *insiders* va à l'opposé de ceux des novices, ce qui va dans le sens de l'hypothèse de Bourdieu (1979) selon laquelle les personnes qui s'engagent dans les arts sont guidées par un processus d'individualisation par lequel elles aspirent à se distinguer des autres. Enfin, nous constatons que le consensus des collectionneurs sur l'appréciation est positivement lié à la reconnaissance de l'artiste, tandis que pour les sujets novices, leur appréciation est négativement liée à la reconnaissance de l'artiste. Cela montre que les *outsiders* ne partagent aucunement les conventions qui régissent le marché de l'art étudié. Nos conclusions suggèrent que les prix de l'art ne peuvent pas être compris en termes esthétiques et émotionnels larges, mais plutôt par rapport aux codes esthétiques établis et partagés par les *insiders*.

Ce chapitre contribue à la littérature de deux manières. Premièrement, nous considérons pour la première fois la perception subjective humaine des œuvres d'art dans un modèle d'évaluation du prix des œuvres, tandis que la littérature a exclusivement tenu compte de facteurs objectifs. Plus précisément, nous nous penchons sur l'influence des consensus en matière de goût et d'émotion dans différents groupes sociaux sur les prix de l'art aux enchères, un sens de causalité inexploré. Deuxièmement, cette recherche est la première à étudier la perception de l'art dans un véritable groupe d'initiés au sens économique du terme (*insiders*), car jusqu'à lors les études sur les évaluations de l'art prennent en considération des groupes d'experts en art — en opposition à des sujets naïfs — tels que les étudiants en art ou les personnes ayant une formation artistique. En conclusion, cette étude permet de mieux comprendre la perception humaine, les préférences partagées et l'interaction entre les jugements esthétiques et les prix.

Le **chapitre 3** étudie l'influence des stratégies organisationnelles et promotionnelles des maisons de vente aux enchères d'une part, et le comportement des commissaires-priseurs lors des ventes aux enchères d'autre part, sur la probabilité de vente, sur le prix réalisé aux enchères, mais aussi sur la différence entre le prix estimé avant la vente et le prix réalisé. Bien que ce chapitre s'appuie sur deux disciplines – le marketing et l'économie – enrichissant toutes deux notre compréhension des enchères, l'approche choisie pour répondre à ces questions est celle du marketing.

La littérature existante accorde peu d'attention au « troisième acteur » de la vente aux enchères, c'est-à-dire à l'agent de vente, outre le vendeur et l'acheteur. Dans de nombreuses études, aucune distinction n'est faite entre le vendeur et l'agent de vente aux enchères, ou ce dernier est considéré comme un intermédiaire passif entre le vendeur et les acheteurs potentiels. Cependant, l'organisateur de la vente aux enchères a différents moyens à sa disposition pouvant avoir un impact sur les résultats des enchères. Les études précédentes ont principalement porté sur les règles régissant les ventes aux enchères et qui sont choisies par l'organisateur des enchères, telles que le format des enchères (Maskin et Riley 1980, Harris et Raviv 1981, Milgrom et Weber 1982), la nature de l'enchère (Isaac et al. 2005, He et Popkowski Leszczyc 2013), le montant des frais imposés aux acheteurs et aux vendeurs (Morwitz et al. 1998, Yao et Mela 2008, Ginsburgh et al. 2010) et la présence de pénalités ou de garanties (Greenleaf et al. 1993, Greenleaf et Sinha 1996, Greenleaf et al. 2002). Une fois les règles relatives à la vente fixées par l'organisateur des enchères, toutes les activités préalables à la vente demeurent, c'est-à-dire le travail concret et quotidien de la maison de vente aux enchères et du

commissaire-priseur. Les maisons de vente aux enchères disposent d'outils organisationnels et promotionnels avant la vente, tandis que les commissaires-priseurs peuvent utiliser différents types d'interventions lors de la vente aux enchères. Certaines variables liées à ces aspects ont été testées dans quelques études, comme le numéro du lot (Beggs et Graddy 1997, Campos et Barbosa 2008), la présence d'une illustration dans les catalogues de vente (Agnello et Pierce 1996, D'Souza et Prentice 2002) et la longueur de la description du lot (Cinefra et al. 2019). Cependant, à notre connaissance l'impact des actions du commissaire-priseur humain lors des ventes aux enchères physiques sur le prix n'a pas fait l'objet d'études empiriques antérieures. Lacetera et al. (2016) mesurent une variabilité des performances des commissaires-priseurs qui suggère que la performance du commissaire-priseur au cours des enchères est déterminante. En empruntant une approche hédonique des prix, nous examinons l'influence du travail quotidien des maisons de vente aux enchères et de la manière de conduire les enchères par le commissaire-priseur sur les résultats de la vente. Pour ce faire, nous avons construit un ensemble de données grâce aux informations des catalogues et à des enregistrements vidéo des ventes aux enchères. Notre base comprend 1101 œuvres d'art mises aux enchères entre mars 2017 et mai 2018 par six maisons de vente aux enchères différentes et sept commissaires-priseurs.

Nos résultats montrent que certains effets d'organisation, de promotion et liés au commissaire-priseur jouent un rôle dans l'explication des résultats de la vente. Premièrement, nous constatons que de nombreux effets organisationnels exercent une influence sur la probabilité de vente et sur les prix, tels que le niveau de concurrence avec des ventes similaires, le nombre de lots du même artiste présentés dans la vente, la présence d'un complément ou la décision de vendre des lots comprenant plusieurs éléments. Deuxièmement, les efforts promotionnels réalisés par les maisons de vente aux enchères entraînent une hausse des prix des œuvres d'art. En particulier, la présence d'un commentaire positif écrit dans le catalogue en amont de la vente semble décisive : elle exerce une influence très significative et positive sur la probabilité de vente, le prix et l'écart entre le prix final et l'estimation avant la vente. Enfin, nous montrons que le commissaire-priseur professionnel a une influence importante sur les résultats. D'une part, l'utilisation de l'humour par le commissaire-priseur joue un rôle important dans la détermination de la probabilité de vente et du prix de vente aux enchères. D'autre part, la différence entre le prix final et l'estimation est principalement déterminée par le comportement de commissaire-priseur, dont le rôle en tant que vendeur semble crucial pour délivrer une expérience divertissante des enchères dans un climat de confiance, plutôt que pour apporter un point de vue expert sur les œuvres en vente.

Nos contributions sont triples. Premièrement, nous fournissons un ensemble de variables qui rendent compte des efforts des maisons de vente aux enchères en ce qui concerne l'organisation des ventes et la promotion des lots destinés à la vente afin de tester leurs effets sur les résultats des ventes aux enchères. Deuxièmement, nous procédons à l'analyse des interventions du commissaire-priseur lors d'enchères traditionnelles et les relions aux résultats des enchères. Troisièmement, outre la probabilité de vente et les prix, nous examinons les déterminants de la différence entre le prix réalisé et le prix estimé d'une œuvre. Les conclusions de cette étude offrent des éclairages importants en matière de stratégies aux acteurs du marché. Les effets de la maison de ventes aux enchères détectés ici révèlent l'importance économique des stratégies des maisons de vente aux enchères et fournissent des orientations quant à l'organisation des ventes aux enchères et à la promotion des lots, afin de maximiser leurs recettes. Qui plus est, nous démontrons l'influence des actions du commissaire-priseur — en particulier le recours à l'humour — sur le comportement des enchérisseurs au cours de la vente aux enchères, impactant par conséquent les résultats finaux. Cette observation peut être utilisée dans le processus de recrutement des commissaires-priseurs et montre l'utilité des programmes de formation à l'humour pour ces derniers. En conclusion, cette étude permet de mieux comprendre le comportement des commissaires-priseurs, les mécanismes par lesquels les maisons de vente aux enchères et les commissaires-priseurs impactent les résultats, ainsi que le fonctionnement des marchés de vente aux enchères physiques.

Le **chapitre 4** examine si et comment la dynamique des enchères influence le prix final des enchères. La théorie classique des enchères suppose que les enchérisseurs participent aux enchères avec une évaluation du bien qu'ils ont fixée en amont de la vente. Toutefois, différentes études empiriques présentent des résultats suggérant que les enchérisseurs ne se conforment pas à leurs évaluations de la valeur faites *ex-ante* mais qu'ils ajustent plutôt leurs prix de réserve tout au long du processus d'enchères.

Un premier courant de recherches a étudié différentes caractéristiques du processus d'enchères ayant un impact sur les prix finaux. Par exemple, le montant de la mise à prix dans les enchères en ligne a une influence significative sur le prix final des enchères (Häubl et Popkowski Leszczyc 2003, Lucking-Reiley et al. 2007, Ku et al. 2005). Également, l'action d'enchérir implique des aspects émotionnels, d'où le phénomène appelé « fièvre des enchères », qui peut altérer la prise de décision et entraîner une hausse des prix (Ku et al. 2005, Jones 2011, Adam et al. 2011, Adam et al. 2015). De plus, la durée d'ouverture des enchères en ligne et la limite de temps dans ces enchères semblent avoir un impact significatif sur le prix final des

enchères (Bajari et Hortaçsu 2003, Ockenfels et Roth 2006, Haruvy et Popkowski Leszczyc 2010, Cao et al. 2019). Outre ces études axées sur des statistiques synthétiques du processus d'enchères afin de mettre en évidence l'importance des stratégies des enchérisseurs, un deuxième ensemble de publications a analysé la dynamique des enchères, c'est-à-dire la distribution des enchères sur la durée de l'enchère d'un bien. Ces études ont développé des outils avancés de visualisation de la séquence des enchères (Shmueli et Jank 2005, Hyde et al. 2006, Shmueli et al. 2006) mais aussi des modèles de la dynamique des enchères en ligne pour prédire la dynamique des enchères (Park et Bradlow 2005, Wang et al. 2008, Jap et Naik 2008) et pour mieux comprendre quels facteurs influencent la dynamique enchères en ligne aux différents moments de la séquence des enchères (Reddy et Dass 2006, Bapna et al. 2008). La plupart de ces études sont axées sur la dynamique des enchères en ligne pour lesquelles les données sont librement et facilement accessibles.

Dans ce chapitre, nous examinons la dynamique des enchères anglaises physiques — qui diffèrent des enchères en ligne par de nombreux aspects — et plus particulièrement si le degré d'agressivité de l'enchère et le rythme des enchères aux différentes phases du processus d'enchères sont neutres vis-à-vis du prix final des enchères ou si au contraire ils influencent le résultat des enchères. Nous supposons que si la dynamique des enchères a une influence sur le prix, c'est que les prix de réserve des enchérisseurs (*i.e.* prix le plus élevé qu'ils sont disposés à payer pour le bien) sont « flous », c'est-à-dire que les prix de réserve des enchérisseurs s'ajustent au cours du processus des enchères (comme l'ont souligné Cramton 1998, D'Souza et Prentice 2002, Heyman et al. 2004 et Hou 2007). L'existence de prix de réserves flous justifie l'adoption de stratégies pour les enchérisseurs. Toutefois, ces stratégies sont susceptibles de varier en fonction de la phase de l'enchère (début, milieu ou fin des enchères) au fur et à mesure de l'évolution du processus d'enchères. Nous avons ainsi construit des indices capturant la dynamique des enchères pour chacune des trois étapes principales de la vente aux enchères. Notre base de données collectée manuellement comprend les prix, la dynamique des enchères et les caractéristiques de 547 œuvres d'art vendues aux enchères entre mars 2017 et mai 2018.

Nous confirmons le rôle de la dynamique des enchères reflétant des comportements stratégiques des enchérisseurs dans l'explication des prix finaux aux enchères. Conformément à notre cadre théorique, ce résultat confirme l'importance des prix de réserves flous des enchérisseurs qui conduisent ces derniers à soumettre des offres agressives ou modérées. Nous montrons que les offres agressives sont significativement et positivement liées au prix final, en particulier au début et à la fin des enchères. Cette agressivité émane d'enchérisseurs particulièrement motivés par la perspective de remporter le lot plutôt que de préserver leur

surplus. L'effet des enchères agressives sur le prix est plus faible à la fin du processus d'enchères qu'au début. Ce résultat peut s'expliquer par les duels finaux qui peuvent engendrer du découragement parmi les enchérisseurs, ce qui atténue l'influence des enchères agressives en fin d'enchères sur le prix. Ensuite, nous constatons que le rythme des enchères a une influence importante sur le prix. L'excitation initiale, qui peut être interprétée par les enchérisseurs comme un signal de vif intérêt pour le lot (c'est-à-dire qu'ils peuvent mettre à jour la composante de valeur commune de leur évaluation), augmente le prix final. En outre, les accélérations tardives, qui reflètent des duels ultimes d'enchérisseurs, augmentent le prix final. Ces résultats suggèrent que les effets de motivation — émanant d'enchérisseurs qui cherchent à remporter le lot plutôt que de faire une bonne affaire — semblent être les plus forts pour expliquer les prix finaux par rapport à d'autres effets tels que le découragement.

La contribution de ce chapitre est double. Premièrement, nous proposons un cadre conceptuel pour les prix de réserve flous des enchérisseurs. Deuxièmement, cette recherche contribue à une meilleure compréhension de la dynamique des enchères et des comportements des enchérisseurs en offrant un aperçu aisément compréhensible de la dynamique des enchères et de son impact. Nous fournissons également l'analyse d'un cas de ventes aux enchères dans des maisons de vente aux enchères physiques avec un commissaire-priseur qui réalise la vente, ainsi que de ventes aux enchères de biens hédoniques, qui n'ont jusqu'à présent reçu que peu d'attention. Les résultats de cette étude ont des implications pour les commissaires-priseurs et les enchérisseurs. Le commissaire-priseur peut utiliser des stratégies pour encourager l'excitation initiale, les duels et l'agressivité des offres. Les enchérisseurs doivent avoir conscience que plus leur offre est agressive, plus le prix final pour obtenir le lot est susceptible d'être élevé.

Pour conclure, ce travail de thèse étudie le marché de l'art, un marché aujourd'hui important et qui devrait continuer de croître. Cette thèse met en lumière divers déterminants des prix de l'art vendu aux enchères , mais aussi de la probabilité de vente et de la différence entre le prix estimé avant la vente et le prix réalisé. Ce travail contribue à la littérature économique et de marketing en apportant de nouveaux ensembles de données, des méthodologies originales et des contributions empiriques.

Enfin, ce travail comporte certaines limites qui ouvrent des pistes prometteuses pour des futures recherches. Premièrement, le prix réalisé aux enchères est le résultat des évaluations de l'offre et de la demande (*i.e.* les évaluations du vendeur et des enchérisseurs), mais l'approche

hédonique des prix que nous utilisons ne permet pas de distinguer les comportements des acheteurs et des vendeurs. Des données supplémentaires sur les caractéristiques des vendeurs et des enchérisseurs permettraient de comprendre les préférences et les comportements individuels. Toutefois, l'accessibilité de ces données reste problématique étant donné que les maisons de vente aux enchères respectent l'anonymat des enchérisseurs et des vendeurs. Il est en effet interdit aux maisons de vente aux enchères de révéler le nom du vendeur ou de l'acheteur d'un lot, sauf accord explicite sur la vente d'une collection, par exemple. D'autres outils pourraient s'avérer pertinents, comme l'approche expérimentale, pour distinguer entre les comportements des acheteurs et des vendeurs. Deuxièmement, nous utilisons des données transversales sur une période d'un an, *i)* afin d'obtenir un degré élevé de précision des variables reflétant les effets que nous avons voulu tester, nécessitant une collecte manuelle de données et aboutissant donc à un nombre d'observations inférieur à celui des bases de données électroniques, *ii)* parce que le marché des originaux de bande dessinée est jeune et que les informations étaient moins abondantes et moins fiables dans les catalogues des premières ventes aux enchères dédiées aux originaux. D'autres recherches pourraient permettre d'observer les effets des déterminants des prix de l'art que nous avons mis en évidence sur une période plus longue. Troisièmement, nous nous concentrons sur le marché des originaux de bande dessinée pour mener nos recherches. Il serait intéressant d'étudier d'autres marchés d'enchères pour voir si nous retrouvons nos effets relatifs aux effets des maisons de vente aux enchères, des commissaires-priseurs et de la dynamique des enchères sur ces marchés. Il serait également intéressant d'explorer d'autres marchés de l'art, en particulier les nouveaux marchés tels que celui de l'art urbain (ou *street art*), car les études précédentes analysant les déterminants du prix de l'art se sont souvent concentrées sur le marché de la peinture. Quatrièmement, un prolongement naturel de notre étude sur les effets des maisons de vente et du commissaire-priseur viserait à étudier si la personnalité du commissaire-priseur (âge, sexe, formation, famille, mais également leurs gestuelle et position durant la vente) joue un rôle dans la détermination des résultats des enchères. Cinquièmement, des recherches futures pourraient utiliser l'approche de l'analyse de données fonctionnelles, ce qui permettrait d'affiner l'étude de la dynamique des enchères.

Enfin, les bases de données et méthodologies originales utilisées pour ce travail peuvent être exploitées à des fins de recherche future.

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Les mécanismes d'enchères et la formation des prix sur le marché de l'art

Résumé

Ce travail s'intéresse à la formation des prix sur le marché de l'art ainsi qu'aux mécanismes d'enchères grâce à une base de données originale collectée manuellement. Tout d'abord, nous étudions les déterminants du prix, mais aussi de la probabilité de vente des œuvres d'art. Nous mettons à jour un ensemble de déterminants de différentiation verticale en nous focalisant sur le marché des originaux de bande dessinée, particulièrement intéressant de par la nature hybride des biens échangés. Puis, nous montrons que le consensus sur des perceptions subjectives d'individus lambda (*outsiders*) et de collectionneurs (*insiders*) impacte les prix grâce à un questionnaire et un indice que nous avons construits. Ensuite, nous analysons le mécanisme d'enchères ascendantes « à la criée » et démontrons que le commissaire-priseur ainsi que la maison de ventes aux enchères ne sont pas des agents neutres car leurs interventions participent à la fixation des prix et au ratio prix réalisé-prix estimé. Enfin, nous examinons la dynamique des pas d'enchères et montrons que l'agressivité des enchères et le rythme à différents moments de la vente d'un lot impactent le prix final.

Mots clés : prix de l'art, enchères, régressions hédoniques, marché des originaux de bande dessinée

Abstract

This dissertation studies the formation of prices on the art market and the auction mechanisms by using a unique hand-collected database. First, we examine different determinants of artworks' prices but also of artworks' probability of sale at auction. We bring to the literature a missing set of vertical differentiation determinants by focusing on the comic art market where the traded goods have a noteworthy hybrid nature. Also, we show that shared aesthetic judgments on liking and emotional responses to art from ordinary people (outsiders) and collectors (insiders) both have an impact on prices, by means of a questionnaire we created and of a consensus index we constructed. Then, we analyse oral outcry ascending auction mechanisms and we demonstrate that human auctioneers and auction houses are not neutral intermediary agents but that their behaviors and marketing efforts systematically influence the outcome of the sale, prices and the realized price-estimated price ratio. Finally, we explore whether and how the bid dynamics influence final prices and we show that aggressiveness of bids and the pace at various phases of the auction impact the price.

Keywords: art prices, auctions, hedonic regressions, comic art market