How to Deal with Misattributions in the Art Market. Exploring Labeling Strategies and Price Setting in the Tertiary Market

Anne-Sophie V. Radermecker[*], Francesco Angelini[†], and Maria Marchenko[‡]

August 20, 2021

Abstract

In this paper, we explore labeling strategies in markets trading credence goods and characterized by asymmetric information. Using the art market as a specific case study, we focus on labeling and price setting strategies behind autograph (A) and non-autograph artworks (NA). Non-autograph artworks (i.e., whose authorship is unknown) represent a significant proportion of credence goods put up for sale at auction. In this paper, we build a theoretical model to better understand the labeling and pricing strategies set by the sellers and to provide elements of a response to the following question: What are the auction houses' incentives/constraints to opt for one label over another (A/NA)? Our theoretical model takes into account a set of exogenous and endogenous forces suspected to explain the correlation between the choice of a particular labeling strategy and the final price (e.g., quality, research costs, etc.). Assuming that the price of A works is higher than that of NA works, the main outcome of our model suggests that using the most honest label and information regarding a work's actual nature might be the more profitable strategy for the seller, but only in certain conditions. The necessary condition for mislabeling an artwork are the high costs required to verify its quality, and the uncertainty on this quality that exists when the verification is not done introduce an endogenous price cap for autograph artworks. This questions the importance of reputation in this type of markets. This paper has direct implications for art market players for it relates to optimal naming treatment strategy.

JEL classification: Z11, L11, L15, D04

Keywords: labeling strategies, tertiary art market, misattributions, art pricing.

1   Introduction

Information asymmetry is a typical market failure especially faced by markets dealing with experience and credence goods (Akerlof 1970, Ekelund et al. 1995, Ekelund & Thornton 2019, Ekelund et al. 2020). While the quality of the first category of goods can reasonably be evaluated post-purchase and at lower costs, the latter offers credence qualities that can hardly be assessed without incurring significant search costs (Darby & Karni 1973). The difficulty in assessing the properties of a good upstream consumption, together with

---

[*]Free University of Brussels

[†]*Corresponding author* – Department of Statistical Sciences "Paolo Fortunati", University of Bologna, francesco.angelini7@unibo.it

[‡]University of Economics and Business, Vienna

adverse selection, leads to situations of growing uncertainty that are detrimental to all parties involved in a transaction. The art market is a compelling example of a market characterized by behavioral anomalies and asymmetric information between buyers and sellers. Artworks, whose characteristics are reminiscent of information, experience, and (meta)-credence goods, are among the most affected by quality uncertainty (e.g. Dempster 2014, Ekelund et al. 2020).

Following Akerlof's pioneering work on information failure and market inefficiency, economists have introduced the advertising and signaling theories to mitigate the undesirable effects of asymmetric information and risk aversion (Stigler 1961, Nelson 1970, 1974, Spence 1973, 1974). When prospective buyers have a reason to challenge quality claims, sellers can rely on a set of signals that contribute to mitigating quality uncertainty (Kirmani & Rao 2000). In particularly subjected to information asymmetry markets, such as financial markets (e.g., bonds, sovereign debts), online sales, or the art market, these signals can take various forms. They include, for example, strong reputation associated with brand names, knowledgeable intermediaries with high levels of expertise, quality products, warranty, or consumers' rating based on prior consumption. All offer competitive advantages by increasing customer's trust (e.g. Flandreau & Flores 2009, Macey 2010, Ranchordás 2019). Among these, reputational mechanisms have been of particular scholarly attention (e.g. Bakos & Dellarocas n.d., Bonroy et al. 2013). Kreps & Wilson (1982) and Milgrom & Roberts (1986) have notably investigated original treatments of reputation formation in games of incomplete information. By building their reputation and developing self-regulatory mechanisms, leading economic agents and intermediaries send strong information signals to potential buyers about the reliability and credibility of their business. Brand building is another efficient strategy, closely related to reputational mechanisms, that mitigates uncertainty around unobservable quality (e.g. Aaker 1992, 1996, 1997, Kapferer 1997, Keller 1998). Before any purchase, potential buyers may consider the information conveyed by the brand based on their knowledge of it (e.g. Kreps & Wilson 1982, Weigelt & Camerer 1988, Herbig & Milewicz 1995). Other research has acknowledged the valuable role of experts as middlemen in the markets with unequally distributed information, where their expertise contributes to increasing buyers' confidence (e.g. Ginsburgh & van Ours 2003, Goldin & Rouse 2000).

The economic features of this market compel its stakeholders to invest in reputation building and to operate in good faith to reduce uncertainty and increase buyer's willingness to pay (e.g. Coffman 1991, Frey & Eichenberger 1995, Goetzmann 1995, Worthington & Higgs 2004). In this paper, we specifically focus on a particular signal known as labeling. When dealing with credence goods, labeling is a strategy that communicates to the buyer about a good's level of quality (Roe & Sheldon 2007). If verifying and assessing quality is a costly task, the practice of labeling – as an indicator of quality – can make it possible for credence good to becoming an experience good, allowing the buyer to reasonably assess its properties after consumption (Ekelund & Thornton 2019). Therefore, products bearing a quality label should offer higher quality standards, resulting in a higher price than similar but lower-quality products (Monroe 1973, Wolinsky 1983). Prior research has indeed shown that labels must reflect the good's superior nature to be credible and trustworthy. In the long run, discrepancies between the quality label and the actual properties of the good may have negative externalities, such as reputation damage or buyer's reluctance towards repeating purchases (Kirmani & Rao 2000). Supplying credence goods and controlling for quality remain very costly in terms of marginal production and research costs, opening the door to opportunistic behavior (Bonroy & Constantatos 2008).

While leading companies such as Christie's and Sotheby's are considered gatekeepers of the auction market due to their long-standing reputation artworks themselves are also concerned with branding strategies. The conflation between the work's designation and the artist's name, itself viewed as a brand, is a common practice (e.g. Schroeder 2005, Muñiz et al. 2014, Angelini et al. 2019). It is indeed common to talk about a work using the creator's name, such as "a Warhol," "a Picasso," or "a Da Vinci." Each artist's name conveys information about the artist's reputation and mastership, operating as a brand that can make significant price differences in the art market. The importance of the artist's name brand has led Hernando & Campo (2017) to introduce the brand value to explain the marketing and economic impact of authorship in the art world. Yet, like any other consumer good, artworks can either be branded when the artist's name is known or left unbranded when authorship is uncertain or unknown (Png & Reitman 1995). In this case, the lack of information surrounding authorship is the consequence of two possible scenarios: the definitive loss of information or a temporary lack of knowledge that only further research could offset. Uncertainty about authorship leads to information failure in a market that perceives the artist's name as one of the most valuable quality signals and price determinants. Unlike received ideas, these unbranded works, also known as non-autograph or indeterminate works (Lupton 2005), represent a significant proportion of the art market, especially with old masters whose works are the most persuasive examples of credence goods. When authorial evidence is missing, the sellers can label the work as autograph or non-autograph, based on a tradeoff between honesty and search for profit.

Building upon Ginsburgh et al. (2019) and Ekelund et al. (2020), we explore the mechanisms of branding in the art market by focusing on labeling strategies and price-setting behind autograph (A) and non-autograph artworks (NA). Recent examples of fakes and reattributions on the art market, including that of the Leonardo da Vinci's Salvator Mundi (Christie's 2017, 450 million), whose authorship has seriously been questioned, make this research relevant to highlight the economic impact of opting for one labeling strategy over another in the art market. The strategic choice of labeling work as a genuine, a copy, or a fake is, therefore, a key concern for economists for it can disturb market efficiency (Mossetto & Vecco 2004). In this paper, we propose a theoretical model that considers artworks as credence goods and contributes to a better understanding of how labeling and pricing strategies function in the art auction market. More specifically, we provide elements of a response to the following question: what are the auction houses' incentives and constraints to opt for a label over another (i.e., autograph (A) or non-autograph (NA))? Our theoretical model considers a set of exogenous and endogenous forces suspected to explain the correlation between the choice of a particular labeling strategy and the final price, including authorship (as evidence of quality) and research costs. Our analysis aims to understand better the sellers' strategic choices in setting prices and to provide a solution to avoid misattributions that are commonplace in certain market segments, with dramatic effects on prices. Assuming that the price of autograph works is higher than that of non-autograph works, the main outcome of our model suggests that, even in a situation of relative uncertainty, labeling a work according to its suspected nature might be the most profitable strategy for a seller (either autograph or non-autograph). The only condition for mislabeling an artwork is the high costs required to verify its quality; a work that auction houses, as gatekeepers of the art market, are theoretically expected to engage in. When the costly verification of the quality is not carried through, the uncertainty on quality existing in this market introduces a price cap for autograph-labeled artworks. The price cap has a role in cases where the seller is endowed with an actual autograph artwork and with a non-autograph one. This paper has direct implications for art

market players for it relates to optimal naming treatment strategy and pricing strategy. We also expand and connect our theoretical model to legal considerations. More specifically, we explore the possibility of developing a price-based regulatory tool aiming to mitigate the risk of opportunistic behaviors in the authentication process. Several advantages and limitations of such a legal attempt to regulate attributions practices in the art market are introduced and briefly discussed. More broadly, the paper contributes to the literature on information and market failure, signaling theory, and uncertainty in the art market by setting up a model that considers all these features in the same framework.

The paper is organized as follows. Section 2 provides the theoretical framework and highlights some properties of the market segment under review. These features are considered in a model developed in Section 3. Section 4 concludes by formulating recommendations for practitioners and discusses future research directions.

2 Literature Review and Modelling background

The greatest uncertainty faced by art market players concerns the subjective notion of quality, the instability of aesthetic value – artists' market performance being likely to shift over time, – the difficulty of certifying authorship and the corollary risk of reattributions (e.g. Moulin 2009, Beckert & Rössel 2013, Beckert 2020). Prior research in economics and sociology has highlighted various means of mitigating quality uncertainty and information asymmetry in the art market. The crucial role of gallerists and auction houses as certifiers and gatekeepers is acknowledged (Velthuis 2005, Shortland & Shortland 2020), as that of cultural institutions and other stakeholders (experts, critics, collectors, etc.) in the mechanisms of value co-creation (e.g. Moulin 1992, Preece & Kerrigan 2015, Preece et al. 2016, Beckert 2020, Angelini & Castellani 2021). The mention of a publication in which the work is discussed, information about its exhibition history, a well-documented provenance, or the inclusion of the artist's name in a reference dictionary constitute another set of measurable hedonic variables that reflect the work's quality, with significant effects on prices (e.g. Renneboog & Spaenjers 2013). Scholars and expert's opinions, due to their long-standing acquaintance with art, also contribute to reassuring buyers in their purchasing decision (e.g. Spencer 2004, Moulin & Quemin 1995, Fincham 2017). Certificates and catalogues raisonnés are other variables that influence the buyers' willingness to pay; their mere presence in a sales catalogue acting as a guarantee of authorship that is highly valuable from the demand side (e.g. Euwe & Oosterlinck 2017, Ginsburgh et al. 2019, Oczkowski 2021). The positive signal sent by the artist's name as a brand, as well as the ability of artists to operate as brand managers, have also been the focus of recent marketing studies (e.g. Schroeder n.d., 2005, Holt 2004, Kerrigan et al. 2011, Hernando & Campo 2017, Angelini et al. 2019). Brand names building is now viewed as a crucial marketing strategy for artists to make their place in the art world and to perform in the art market, each name sending informational signals about their reputation, career, and works to potential buyers, who are therefore better informed on the nature of the desired good and willing to pay accordingly (e.g. Hernando & Campo 2017).

Despite the importance attached to branding strategies in the art world, the process of labeling the goods remains a topic marginally addressed in art market research. If this issue is discussed in economic studies (Teisl & Roe 1998, Crespi & Marette 2001), papers dealing with art auction traditionally pay more attention to issues related to bidding strategies (Ashenfelter & Graddy 2003, 2011), presale estimates and reserve prices (Beggs & Graddy 1997, Ekelund et al. 1998, Czujack & Martins 2004, Mei & Moses 2005, McAndrew et al.

4

2012a, Beggs & Graddy 2008, Castellani et al. 2018), or sales modalities (De Silva et al. 2012). The issue of labeling strategies in the art market is also very much linked to the issue of experts' opinions. Milgrom (1981) studied the credibility and reliability of experts' discourse, through a persuasion game approach. Shin (1994) looks at games where experts are themselves not entirely informed and are unable to prove how imprecise his information is. Chakraborty & Harbaugh (2010) focus on the persuasiveness of experts' cheap talks, while Bonroy et al. (2013) show that risk aversion tends to reduce experts' efforts to provide the right treatment. While Milgrom & Weber (1982) state that honesty is the best policy, Crawford & Sobel (1982) and Dziuda (2011) findings suggest the contrary, the authors arguing that full disclosure of information does not automatically lead to an equilibrium and is therefore not the most advantageous policy. In economic research dealing with the art market, two studies in particular are worth highlighting. Ginsburgh et al. (2019) discuss the impact of authorship certification in the art market, although their empirical study focuses more on capturing the impact of the publication of a catalogue raisonné on art prices rather than on the strategic choice behind labeling a work as autograph or non-autograph. Ekelund et al. (2020) have introduced the concept of meta-credence good, and, using a formal Bayesian model, they rationalize the expert's authentication process by stressing the importance of consensus between experts when determining the status of credence goods. To the best of our knowledge, our model is the first to consider the labeling strategies used by auction houses when dealing with credence goods, namely their incentives to label a work as autograph or non-autograph depending on what nature gives them.

Before discussing the model, different scenarios auctioneers and cataloguers may face when cataloguing the lots put up for sales must be addressed. Any artwork necessarily bears a designation that is duly chosen by in-houses experts, sometimes with the help of external peers or scholars. When being given a work, the auction houses can opt for several labeling strategies, based on available information and the work's intrinsic characteristics. When authorship can be guaranteed with certainty, thanks to factual evidence (genuine signature, mention in archives, etc.), the work is identified with the name of its author and is therefore considered "autograph". This constitutes an ideal case scenario in the art market, although far from being the rule. Artworks whose authorship is unknown are indeed regularly encountered in the art market, depriving potential buyers from the positive signals sent by the artist's name. These indeterminate works resemble, to a certain extent, to copycat products, namely goods offering similar but cheaper characteristics of a leader brand (Gentner 1983, Van Horen & Pieters 2013). Three main labeling strategies in particular are used by art market players to reduce information asymmetry: indirect names, provisional names, and spatiotemporal designations. The first strategy consists in using an attribution qualifier to connect an indeterminate work to an identified name indirectly (Onofri 2009, Renneboog & Spaenjers 2013, Radermecker 2020). The second can be assimilated to a nickname given to an unknown artist who supposedly executed several works (Oosterlinck & Radermecker 2019). The third labeling strategy is preferred when no convincing connections can be made with the work of an identified artist. In this event, the work bears a spatiotemporal designation that merely locates the work in its geographical and chronological context (Radermecker 2019). These three identification strategies, encompassed under the category of "non-autograph works," send relatively different signals to buyers who are informed of their difference in meaning thanks to complementary information provided by auction houses in their glossary of terms. More broadly, as any other kinds of labels, these attribution strategies allow sellers to create product differentiation in a market made up of relatively homogeneous products (Baltzer 2011).

For ease of modelling, the present study will dissociate autograph from non-autograph works; a distinction already found in Ginsburgh et al. (2019). While this choice entails a necessary simplification of reality, it does not affect the credibility of our model since the price gap between both categories has been confirmed by several economic studies (Lazzaro 2006, Onofri 2009, Renneboog & Spaenjers 2013, Oosterlinck 2017, Euwe & Oosterlinck 2017, Ginsburgh et al. 2019, Radermecker 2020). The price difference between autograph and non-autograph works is also reflected on a differential information supply, whose amount depends on the work's overall quality. The artist's name indeed enables cataloguers to provide the buyers with valuable information resulting from research done in art historical literature (i.e., publications, exhibition history, provenance, etc.). Important autograph lots are usually accompanied by scholarly documented essays, providing the buyers with additional details about the work's iconography or the artist's life. Although it can be viewed as an investment enhancing the marketability of the work, carrying out such documentary research is costly, and, consistently with Milgrom & Roberts (1986), only high-quality producers (here leading auction houses) can afford these costs. Yet incurring search costs is necessary to warrant the credibility and trustfulness of the certification process (Bonroy & Constantatos 2015, Crespi & Marette 2001, Ekelund et al. 2020). This is in sharp contrast with non-autograph works, for which information supply decreases substantially, some lots being even left entirely undocumented (Radermecker 2021). The rationale behind the decision of not providing additional information on the lot is strictly economic; because of the lower quality of the work, the marginal costs of documenting it would not be covered by the revenues of the sale, or worse, could be lost should the work goes bought in. This observation confirms the assumption that being autograph is a valuable advantage for both buyers and sellers, in terms of quality, information supply, guarantee, and sales revenues; a set of features that contributes to explaining their higher presale estimates and hammer prices. To some extent, autograph works are assimilable to what Bonroy & Constantatos (2008) call "perfect labels" that establish or restore full information, while non autograph labels may be considered imperfect ones, which "moves everybody's beliefs closer to the truth without restoring full information" and "may produce adverse results on market structure and welfare" (Bonroy & Constantatos 2008).

Hence, when dealing with credence good such as artworks, the choice of labeling a work as autograph or non-autograph can make a significant impact on both the cultural and economic value of the good, sometimes at the expense of the buyer who is not always informed about the authentication process. It might therefore be tempting for a seller to alter the actual identity of a work to enhance its marketability and economic value by labeling the work with a more optimistic label. In such a situation, the search for profit overtakes honesty. Yet, the misuse of quality signal for profit-making might have severe consequences for their reputation. As stated by Giannakas (2002) and reported in Bonroy & Constantatos (2015), "consumers' deception caused by such misleading labeling affects their trust in the labeling process, which has detrimental consequences for the market acceptance of genuinely certified products." If there is a probability of erroneous labeling, and that the buyer is unable to verify the labeling process and the work's quality, customer's full trust will decrease with potential negative externalities for the authority delivering the label (Bonroy & Constantatos 2008). In a market that strongly rely on reputational mechanisms (Shortland & Shortland 2020, Oosterlinck & Radermecker 2021), our assumption is that labeling a work based on its veritable (or at least suspected) nature, and setting presale estimates accordingly, is the most profitable strategy for auction houses. By doing so, they avoid an unjustifiable discrepancy between the work's actual quality and economic value, that might lead to buyers' deception and reluctancy to reiterate purchasing behaviors (Kirmani & Rao 2000).

3   The Model

In this model, we address the labeling strategies auctioneers may opt for when facing credence goods art whose authorship can be subjected to uncertainty.

Two types of agents exist: the seller (s, he) and the buyer (b, she). The seller is endowed with an artwork by the nature (n),[1] and the artwork can either be am actual autograph artwork ($\overline{A}$) or an actual non-autograph artwork ($\overline{NA}$). Once the seller receives the artwork, he has to choose how to label the artwork, that is, either to propose it as an autograph artwork (A) or as a non-autograph one (NA). We assume that the price for non-autograph artworks is in line with the market price, since these artworks are more numerous, and that no buyer would pay more than the average market price, $P_{NA} > 0$, for this type of artworks. If the seller labels the artwork as an autograph, he will also fix a price for that artwork, P_A.

As discussed above, the label works as a signal for the buyer, who has no further information besides the one conveyed by the label. However, she can obtain information about the artwork at sale, but this is costly[2] and would cost $c > 0$. Whether she will get more information or not, she has to decide among buying and not buying the artwork.

The timing of the game is as follows:

I. s is endowed by n with an artwork, that can either be $\overline{A}$ or $\overline{NA}$;

II. s labels the artwork and, if labelled A (strategy A), he also fixes the price P_A, otherwise (strategy NA) the price will be the market price for non autograph paintings, P_{NA};

III. b decides to either collect more information by incurring in a cost $c > 0$ (strategy C) or not (strategy NC);

IV. if b decides to not collect more information, she will choose between buying the artwork at the proposed price (P_A if labelled A or P_{NA} if labelled NA) (strategy B) or not (strategy NB); if b decides to collect more information, she will choose between buying the artwork at the price the artwork should be sold (P_A if $\overline{A}$ and priced P_A, P_{NA} if a $\overline{NA}$ and priced P_A, P_{NA} in all the other cases) (strategy B) or not (strategy NB);

V. payoffs are observed.

Given the choice of n and the possible labels that s can use, we can observe four combinations between the actual attribute of the artwork and the one resulting from the label, as in Table 1.

Cases 1 and 4 are the truth cases, while the 2 and 3 are cases in which the actual and the labelled attribute are not aligned, with an advantage to either the seller (case 3) or the buyer (case 2).

For each of these cases, we have 4 possible strategies the buyer can choose, given by the combinations between the choice of point III and point IV of the timing of the game.

We will identify each final decision point of the game with the number of the respective case, with two subscripts, i and j, where i is 0 if b did not collect information and 1 otherwise, while j is equal to 1 if b

---

[1] Nature endowing an artwork to the seller encompasses both the situation where the seller receives it from a previous owner and the situation where he directly receives it from the artist. The seller is also endowed with all the information available about the artwork.

[2] The cost can be seen as a monetary quantity spent to obtain this additional information from an expert, or as a opportunity cost linked to the time needed to collect the additional information, or both.

Table 1: Nature's and seller's choices

Nature choice	Seller choice	Case
$\overline{A}$	A	1
$\overline{A}$	NA	2
$\overline{NA}$	A	3
$\overline{NA}$	NA	4

decided to buy the artwork and 0 otherwise. So, for example, if we are in case 1 and the buyer buys the artwork after having collected info, we can refer to that final decision point as 1_{11}. Each final decision point will have its couple of payoff for the two players.

If the buyer buys the artwork, she obtains a utility $u(z) > 0$, $z = \{\overline{A}, \overline{NA}\}$, with $u(\overline{A}) \equiv (1+x)u(\overline{NA})$ and $x > 0$. Since her choice of incurring in the cost for obtaining information is made without knowing if the artwork actually is autograph or not, but it is based on the label the seller chooses, she will choose based on an expected value. The probabilities with which the expected value is computed considering the prices of A and NA. However, P_A will be fixed by the seller only if he decides to label the artwork as A; in case he chooses to label the artwork P_{NA}, the buyer will consider it as being $(1+x)$ times P_{NA}, that is, the ratio between the buyer's utility obtained from an autograph artwork and the one obtained from an autograph will be equal to the ratio between the economic value attached to an autograph in case the autograph price was not fixed and the non-autograph market price. So, we have that the two probabilities will be:

$$
\begin{aligned}
Prob\left(\overline{A}|P_A, P_{NA}\right) &= \begin{cases} \frac{P_A - P_{NA}}{P_A} & \text{in cases 1 and 3} \\ \frac{P_{NA}(1+x) - P_{NA}}{P_{NA}(1+x)} = \frac{x}{1+x} & \text{otherwise} \end{cases} \\
Prob\left(\overline{NA}|P_A, P_{NA}\right) &= \begin{cases} \frac{P_{NA}}{P_A} & \text{in cases 1 and 3} \\ \frac{P_{NA}}{P_{NA}(1+x)} = \frac{1}{1+x} & \text{otherwise} \end{cases}
\end{aligned}
\tag{1}
$$

Assuming that both agents do not incur in any transaction cost, the payoffs for the two agents will be the one reported in Table 2.

Table 2: Agents' payoffs

Final decision point	Buyer's payoff	Seller's payoff
1_{11}	$u(\overline{NA})(1+x) - P_A - c$	P_A
1_{10}	$-c$	0
1_{01}	$\frac{u(\overline{NA})}{P_A}[P_A + x(P_A - P_{NA})] - P_A$	P_A
1_{00}	0	0
2_{11}	$u(\overline{NA})(1+x) - P_{NA} - c$	P_{NA}
2_{10}	$-c$	0
2_{01}	$u(\overline{NA})\frac{(1+x)x+1}{1+x} - P_{NA}$	P_{NA}
2_{00}	0	0
3_{11}	$u(\overline{NA}) - P_A - c$	P_A

3_{10}	$-c$	0
3_{01}	$\frac{u(\overline{NA})}{P_A}\left[P_A + x(P_A - P_{NA})\right] - P_A$	P_A
3_{00}	0	0
4_{11}	$u(\overline{NA}) - P_{NA} - c$	P_{NA}
4_{10}	$-c$	0
4_{01}	$u(\overline{NA})\frac{(1+x)x+1}{1+x} - P_{NA}$	P_{NA}
4_{00}	0	0

We now introduce an assumption which is needed to distinguish between autograph and non-autograph artworks, namely we assume that autograph artworks have a higher value than non-autograph ones for the buyer. At the same time, we assume that the market price for non-autograph painting and the price fixed by the seller for autograph ones are such that trade occurs (namely they are lower than the value attached by each type of artwork by the buyer). Moreover, we assume that the economic value of the autograph artwork, as measured by its price, will always be higher than the non-autograph artwork's one.

Assumption 1 $u(\overline{A}) > P_A > u(\overline{NA}) > P_{NA} > 0$

Clearly, in case the buyer does not incur in the cost c, when the seller chose the label A the buyer can not identify if she finds herself in sub-case 1_{01} or 3_{01}, while when the seller chose NA she can not identify if she is in sub-case 2_{01} or 4_{01}. In fact, the buyer will have the same payoff in 1_{01} and in 3_{01}, and in 2_{01} and in 4_{01}. In other words, in case the seller chose the label A, the buyer will face different possible scenarios: she knows that the artwork can either be an actual autograph ($\overline{A}$) or a mislabeled non autograph ($\overline{NA}$). Similarly, if the seller labels the artwork NA, she knows that the artwork can either be a mislabeled autograph ($\overline{A}$) or an actual non autograph ($\overline{NA}$).
Given that, she will form expectations on the actual value of the object, given by the prices of the two types of objects, that is, she will attach probabilities in 1 to the two possible cases.

The buyer can remove this source of uncertainty by collecting more information incurring in a cost c. The choice of paying the cost or not, however, is still made upon uncertain values.

The buyer can then have different information sets which can contain more than one node in the game. In particular, at the step in which she has to choose between incurring in c or not, if the seller chose label A she will have the information set given by the observable label A that will contain cases 1 and 3, while if the seller chose label NA she will have the information set given by the observable label NA that will contain cases 2 and 4.
After this choice, in the last step, different information set can be observed: in all the four cases in which the buyer chose to incur in c (namely $(\overline{A}, A, C)$, $(\overline{A}, NA, C)$, $(\overline{NA}, A, C)$, and $(\overline{NA}, NA, C)$), the information set will contain only one node and no uncertainty about value is present, so the buyer chooses with full information. In all the other four cases (namely $(\overline{A}, A, NC)$, $(\overline{A}, NA, NC)$, $(\overline{NA}, A, NC)$, and $(\overline{NA}, NA, NC)$), the buyer can only observe the label chosen by the seller and knows that she did not incur in c, so she will be uncertain about the value she will obtain after her choice between buying and not buying the object. In particular, for these four cases, two information sets are possible: either A, NC (cases 1_{01} vs 1_{00} or 3_{01} vs
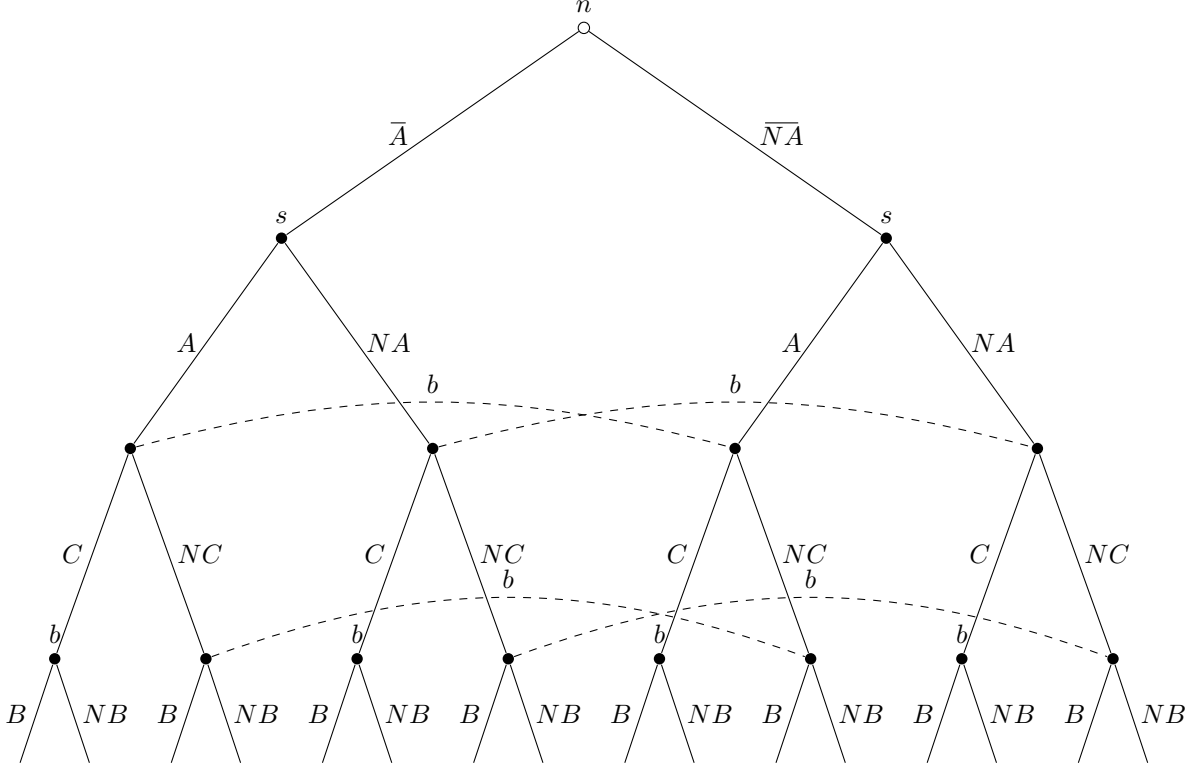
Figure 1: Extended form of the game

3_{00}) or NA, NC (cases 2_{01} vs 2_{00} or 4_{01} vs 4_{00}), so the buyer is uncertain about the artwork being actually an autograph or not (since she did not incur in c). Conversely, the information sets of the seller are always made up of one node only.

The game has hence 5 sub-games: 4 proper sub-games following the choice of the buyer of collecting information and the original full game. The tree of the game can be represented in Figure 1.

To solve the game, we start from the four sub-games in the last step. When the information set is given by $(\overline{A}, A, C)$, the buyer compares buying an actual autograph (B) or not (NB) at the price P_A fixed by the seller. She will buy the artwork if $u(\overline{NA})(1+x) - P_A - c > -c$, which is always the case given assumption 1. In the information set $(\overline{A}, NA, C)$, the buyer will always choose B given $u(\overline{NA})(1+x) - P_{NA} - c > -c$, which is always the case given assumption 1. In case $(\overline{NA}, A, C)$, the buyer has to compare $u(\overline{NA}) - P_A - c$ and $-c$, and in this case, given assumption 1, we know that the latter is greater than the former, hence she will always choose NB. Finally, in the information set $(\overline{NA}, NA, C)$, the buyer has to choose between $u(\overline{NA}) - P_{NA} - c$ and $-c$, and the former will be always preferred to the latter given assumption 1, so she will buy it.

Concerning the two information sets following the buyer's choice NC, that is (k, A, NC) and (k, NA, NC), where k is unknown for the buyer, we can see if the strategy choice the buyer wants to make is independent on the actual value of k. Considering the information set (k, A, NC), the buyer knows that she can either end up having a $\overline{A}$ or a $\overline{NA}$. Since 1_{01} and 3_{01} are equal and 1_{00} and 3_{00} are equal as well, she would have

to compare $\frac{u(\overline{NA})}{P_A}[P_A + x(P_A - P_{NA})] - P_A$ and 0 to choose between strategy B and strategy NB. She will choose B if

$$P_A \leq \frac{1}{2}u(\overline{A}) + \frac{1}{2}\sqrt{-4P_{NA}u(\overline{NA})x + u(\overline{NA})^2x^2 + 2u(\overline{NA})^2x + u(\overline{NA})^2} \equiv \tilde{P}_A$$

If $P_A > \tilde{P}_A$ she will choose NB. So, even if the information set under analysis contains more than one node, the choice of the buyer will only depend on the price fixed by the seller who chose A.

In the case when the seller chose NA and the buyer chose NC, the information set would contain two nodes as well. The choice the buyer has to make would be between $u(\overline{NA})\frac{(1+x)x+1}{1+x} - P_{NA}$ and 0, in both case 2 and 4. $u(\overline{NA})\frac{(1+x)x+1}{1+x} - P_{NA} > 0$ is always true given assumption 1, so in case the seller chose NA and the buyer NC, the buyer will always choose B.

So, in the last step, the buyer who did not collect additional information will always buy the artwork if the seller labels it as non autograph, but, if the seller labels the artwork as autograph, she will buy it only if the price will be lower than a certain threshold, which depends on the value of both the autograph and the non autograph artwork, the average price of non autograph artworks in the market, and the percentage gap between the value of autograph and non-autograph artworks.

Let's focus now on the choice between collecting information or not. In this step, two information sets exist: the one consisting in the seller's strategy A (with the price fixed by the seller P_A), and the one with the seller's strategy NA. In the former case (strategy A), the buyer does not know if she is in the part of the game with $\overline{A}$ or in the one with $\overline{NA}$. What we know from the results above is that, if the price fixed is below $\tilde{P}_A$ and the buyer does not collect more information, she will buy the artwork anyway, while if she decides to collect it, she will buy the artwork only if she finds out it is an autograph. Since she has no way to distinguish between the two cases, we assume she will choose considering the expected value of the payoffs. In case she decides not to collect information, she will obtain $\frac{u(\overline{NA})}{P_A}[P_A + x(P_A - P_{NA})] - P_A$, since she will buy the artwork. In case she decides to collect information, she will either get $u(\overline{NA})(1+x) - P_A - c$ if the artwork is indeed an autograph or $-c$ if it is not. Using the same probabilities she uses in the last step, from (1), we will have that she will decide to collect information in case

$$\frac{P_A - P_{NA}}{P_A}\left(u(\overline{NA})(1+x) - P_A - c\right) - \frac{P_{NA}}{P_A}c > \frac{u(\overline{NA})}{P_A}[P_A + x(P_A - P_{NA})] - P_A$$

which boils down to

$$c < P_{NA} - \frac{P_{NA}}{P_A}u(\overline{NA}) \equiv \tilde{c}$$

So, if the cost is below a certain threshold $\tilde{c}$, which depends on the price of autograph and non autograph artworks and on the value of non autograph artworks, the buyer will prefer to collect information, leading to the B strategy in case the artwork is an autograph, or to the NB strategy if it is not.

In the situation in which the seller labels the artwork as A and fixes a price higher than $\tilde{P}_A$, the buyer will have to compare the payoff she will get in case she will not collect information, which would be 0 (since when $P_A > \tilde{P}_A$ the buyer will prefer not to buy the artwork in case she chose NC and the seller chose A, as we saw above), and the expected value she will get deciding to collect information, which is given by the probability of having an $\overline{A}$ multiplied by the payoff of the buyer in case her strategy would be C, B given $\overline{A}$

and A, that is, $u(\overline{NA})(1+x) - P_A - c$, and the probability of having a $\overline{NA}$ multiplied by the payoff she will get in case she plays NC, B given $\overline{NA}$ and A, that is, $-c$. The buyer will choose to collect more information if

$$\frac{P_A - P_{NA}}{P_A} \left(u(\overline{NA})(1+x) - P_A - c \right) - \frac{P_{NA}}{P_A} c > 0$$

which boils down to

$$c < \frac{(P_A - P_{NA}) \left(u(\overline{NA})(1+x) - P_A \right)}{P_A} \equiv \hat{c}$$

Similarly for the case when $P_A < \tilde{P}_A$, if the cost is below a certain threshold $\hat{c}$ the buyer will prefer the strategy C to NC, and vice versa.[3]

In the case in which the seller chose the label NA, the buyer will know that she will get $u(\overline{NA})\frac{(1+x)x+1}{1+x} - P_{NA}$ in case she will decide not to collect information, whichever is the actual type of the artwork; if she decides to collect information, she will get either $u(\overline{NA})(1+x) - P_{NA} - c$, if the artwork is a $\overline{A}$, or $u(\overline{NA}) - P_{NA} - c$, if it is a $\overline{NA}$. Using the same reasoning we used before, the choice of collecting information will be made if

$$\frac{x}{1+x} \left(u(\overline{NA})(1+x) - P_{NA} - c \right) + \frac{1}{1+x} \left(u(\overline{NA}) - P_{NA} - c \right) > u(\overline{NA})\frac{(1+x)x+1}{1+x} - P_{NA}$$

which is never verified under assumption 1. Notice that this choice do not depend on P_A, since the price has not been fixed by the seller, who chose NA. So, when the seller chose the label NA, the buyer will always decide not to collect more information (NC) and then buy the artwork (B). If the artwork is a non autograph, she will pay the its market price (P_{NA}); if the artwork is an autograph, she will pay the average price for non autograph artworks in the market. Clearly, what we need to see now is what would be the best strategy for the seller, given the buyer's best responses we identified.

Given what we saw so far, we know that when the seller chooses NA as a label, he will sell the artwork in any case, independently on the value of c, so the artwork cannot go unsold but it can at most be sold with a "lower" label, as an exit strategy. What is key, though, is to understand how the seller has to play considering the cost of collecting information and the other exogenous variables in the market (x, $u(\overline{NA})$, and P_{NA}), which influence the thresholds, that are however also influenced by his choice of P_A.

In case the seller receives a $\overline{A}$ from n, he has to choose between labeling it as a NA, knowing that it would be sold at P_{NA}, or labeling it as an A, fixing the price accordingly. In particular, as long as $P_A < \tilde{P}_A$, the seller knows that if $c < \tilde{c}$ the buyer will play C, B and would then buy the artwork, while if $c > \tilde{c}$ she will play NC, B, buying the artwork anyway. If instead $P_A > \tilde{P}_A$, the buyer would buy the artwork (playing C, B) only if $c < \hat{c}$, while she would play NC, NB in case $c > \hat{c}$. Hence, if the cost is low enough (namely lower than $\hat{c}$) the seller can fix a price higher than $\tilde{P}_A$ knowing that he will sold the autograph artwork as an autograph; however, if the cost of collecting information is too high, he could incur in the situation in which an autograph artwork cannot be sold if labelled as autograph, unless the price is not fixed below $\tilde{P}_A$. In case the seller is endowed with a $\overline{NA}$ by n, he has to choose between strategy A and NA, knowing that in the latter case he will sell the artwork at P_{NA} independently on all the other parameters. If he chooses strategy A, mislabeling the artwork, he should take into account that, also in this case, the level of c is

---

[3]Notice that $\hat{c} > \tilde{c}$ when $P_A < \tilde{P}_A$ and vice versa. By continuity, then, $\hat{c} = \tilde{c}$ when $P_A = \tilde{P}_A$.

important. As in the case of $\overline{A}$, the threshold for c depends on P_A and on the other exogenous variables, so when the seller decides the strategy to pursue, he should also fix the price considering these thresholds. In particular, in this case, if the seller will fix a price which is too high (namely higher than $\tilde{P}$) he will not sell the artwork, since if the cost is higher than $\hat{c}$ the buyer will play NC, NB, while if it is lower of $\hat{c}$ she will play C, find out the artwork is mislabeled, and decide to not buy it (NB). Conversely, if the seller will fix a price lower than $\tilde{P}_A$, he could sell the $\overline{NA}$ artwork as an autograph, but only if the cost of collecting information for the buyer is higher than $\tilde{c}$ (the buyer would play NC, B), otherwise she will play C, finding out that the artwork is mislabeled and then deciding to not buy it.

Table 3 reports the matrix of the strategies chosen by the players depending on the value of c and P_A (if fixed).

Table 3: Matrix of strategies

	$\overline{A}$			$\overline{NA}$		
	A		NA	A		NA
	$P_A > \tilde{P}_A$	$P_A \le \tilde{P}_A$	(price not fixed)	$P_A > \tilde{P}_A$	$P_A \le \tilde{P}_A$	(price not fixed)
$c < \tilde{c}$		info collected, sold at $P_A < \tilde{P}_A$	info not collected, sold at P_{NA}		info collected, not sold	info not collected, sold at P_{NA}
$c \ge \tilde{c}$		info not collected, sold at $P_A < \tilde{P}_A$	info not collected, sold at P_{NA}		info not collected, sold at $P_A < \tilde{P}_A$	info not collected, sold at P_{NA}
$c < \hat{c}$	info collected, sold at P_A		info not collected, sold at P_{NA}	info collected, not sold		info not collected, sold at P_{NA}
$c \ge \hat{c}$	info not collected, not sold		info not collected, sold at P_{NA}	info not collected, not sold		info not collected, sold at P_{NA}

From Table 3 we can see that seller has different optimal strategies depending on what he was endowed with and the level of c with respect to the thresholds, and, in certain cases, he is constrained in his pricing strategy by the endogenous price cap $\tilde{P}_A$. In particular, if Nature gives $\overline{A}$ to the seller, then the seller has the incentive to not lie and label it as A as soon as the cost is below the thresholds (which depend on P_A as well), since in these cases the buyer would collect information and be able to recognize the artwork as an actual autograph, so the seller can propose the piece at a price higher than $\tilde{P}_A$ without risking that the artwork goes unsold. When the cost is higher than the threshold, the seller has to choose between proposing it at a price below $\tilde{P}_A$, knowing that it will be sold, or mislabeling it as an NA and selling it at P_{NA}; given assumption 1, this latter strategy is not desirable, and so he would prefer to label the artwork honestly and price it below the threshold.

If instead Nature endows the seller with $\overline{NA}$, then there is again only one case, when the seller has an incentive to lie and attach the label A to the piece, that is, when the artwork is not checked because it is too costly to collect information (namely $c > \tilde{c}$), but then the price cap, given by the threshold $\tilde{P}_A$, limits the price that he can choose for the piece. In fact, if the collecting information is not too costly, the buyer will collect the information if the artwork is labelled as A, finding out that it is indeed a non autograph artwork and then not buying it. If instead the cost of collecting information is too high, the buyer will not collect it even in the case of A-labelled artwork, but she will buy it only when P_A is below the price cap. So, the seller, knowing the cost thresholds, will label the piece as an autograph even though it is an actual non autograph when the cost c is high, fixing a price below the price cap, and selling a misattributed piece. In

the case of a low cost of collecting information, the seller will not mislabel the piece, and will sell it at the market price P_{NA}.

Hence, the only case in which a mislabelled piece is sold is when the seller is endowed with a $\overline{NA}$, the cost to get additional information is above the threshold, and he fixes a price below $\tilde{P}_A$.

So, even in a market where reputation is a key, the reputation mechanism might not be enough to limit opportunistic behaviors. In fact, the case of misattribution we observe in our model is such that, after the trade, the buyer would never know she bought a non autograph work paying it as an autograph (with P_A below the price cap), so no reputation mechanism is at work. In this and similar cases, however, our model suggests that the incentive to behave opportunistically might in principle be strongly limited by the availability of information, as measured by the cost of collecting it. In fact, a (relatively) lower cost of collecting information would reduce the parameter space in which the seller have incentive to not behave in a fair manner.

The main takeaway of the model therefore corroborates Milgrom & Weber (1982)'s long-standing recommendation, according to which, "honesty is the best policy" in the art market. Sellers, therefore, have strong economic incentives to comply with what nature gave them by labeling the work accordingly. However, selling intentionally misattributed works indeed constitute a substantial threat for art market players, not only from a financial and ethic perspective but also in terms of reputation (Marrone & Beltrametti 2020, Bandle 2016). The art market shares strong similarities with markets that strongly rely on the reputation of its stakeholders. Buyers aspire to acquire artworks bearing trustworthy labels to avoid potential deception and financial prejudices in the short, middle or long run. Nevertheless, if misattributions driven by profit should be excluded, one may argue that the lack of regulation still prevents buyers from being entirely protected against opportunistic behavior.

The art market indeed remains one of the most opaque and unregulated market, regardless of recent efforts to tackle some negative externalities resulting from a quasi-non-existent regulatory environment. Current legal instruments chiefly intend to discourage fraudulent behaviors and illicit practices, but also to protect artists' rights, both at the national and international levels. Examples of well-known legislation are the 1954 Hague Convention, the 1970 UNESCO Convention, or the 1995 UNIDROIT Convention (Shortland & Shortland 2020, da Silva 2015). More recently, the National Defence Authorization Act (NDAA) was ratified by the American federal government to closely monitor the market for antiquities and limit the risk of illegal transactions (Small 2021).

Yet, when it comes to attributions, legal protection is almost non-existent. To the best of our knowledge, a notable exception is the Marcus Decree (3 March 1981), passed by the French government in the aftermath of the Affaire Poussin (1978-1983). The erroneous labeling of an actual autograph painting by French master Nicolas Poussin led to a 15-year trial between the sellers and a Paris-based auctioneer (Oosterlinck & Radermecker 2021). The wide media covering this legal case contributed to pressuring the French government to pass a national decree regulating attribution practices on its domestic market. More specifically, the decree's goal is to compel any seller to use legally defined attribution qualifiers when authenticating an artwork. Oosterlinck & Radermecker (2021) have analyzed the impact of this regulation on the market for old master paintings, but have unexpectedly found no conclusive economic effects, whereas in theory the greater guarantee of authorship should have reflected in higher willingness to pay. Among other reasons, the authors attribute this moderate impact to the existence of strong reputational mechanisms found in the

US and UK art markets, since the Marcus Decree itself openly is inspired from the scale of authentication developed by Christie's and Sotheby's. In unregulated setting, the natural reaction of top-tier auction house was to develop a model of self-governance that was progressively taken up by smaller companies according to compliance mechanisms. Indeed, the lack of regulation does not mean that auction houses do not offer protection to buyers. In their *Terms of guarantee*, both Christie's and Sotheby's not only provide buyers with a glossary of terms to clearly dissociate autograph from non-autograph works, but also allow potentially misattributed work to be appealed in the five years following the sale, conditionally to given attribution is not in line with scholars' opinion at the time of the sale. These strict restraints protect both buyers and auction houses from being prosecuted hastily. The latter have indeed strong incentives to avoid public affairs whose media coverage may deteriorate their reputation.

That being said, it is worth noting that none of these public and private instruments touch upon prices per se. In fact, regulation is rarely concerned with price setting. The price fixing scandal, in which Christie's and Sotheby's were involved in the late 1990s, contributed to shedding light on collusion mechanisms in the art trade without, however, leading to any legal advance to prevent similar anti-competitive practices in the future (Ashenfelter & Graddy 2005). Current knowledge on price setting is chiefly based on the prior studies focused on unregulated pricing strategies developed by auction houses, with a particular attention paid to reserve prices and pre-sale estimates (e.g. Castellani et al. 2018, Walley & Fortin 2005, Shi 2013, Ekelund Jr et al. 2013, Beggs & Graddy 2008, McAndrew et al. 2012*b*, Mei & Moses 2005, Bauwens & Ginsburgh 2000, Ekelund et al. 1998). In contrast, our theoretical model raises the possibility of regulating attribution practices to lower the probability of legal and financial prejudices caused by misattributions.

More specifically, the presence of mathematically defined thresholds allows us to study how a stake-holder or a policy-maker can influence these thresholds to change the strategy chosen by the seller. For example, a (potential) regulator of this market might want to prevent mislabeling, in order to maintain the market reliable. To do so, it might intervene to influence the cost thresholds and the price cap for P_A when the misattribution of a $\overline{NA}$ as a A can be observed, namely when $c \geq \tilde{c}$ and $P_A \leq \tilde{P}_A$. In fact, we have:

$$\frac{\partial \tilde{P}_A}{\partial x} > 0$$
$$\frac{\partial \tilde{P}_A}{\partial u(\overline{NA})} > 0$$
$$\frac{\partial \tilde{P}_A}{\partial P_{NA}} < 0$$

To intervene so that the conditions for which the misattribution is not observed are more binding, the regulator should reduce the price cap, and it can do that by increasing P_{NA} and/or decreasing $u(\overline{NA})$ and x. While the effect of having a higher price for non autograph paintings can be explained with the fact that the seller would have a higher pay-off by being honest and by the impact on the perceived probability of the buyer (as in (1)), the effect of reducing the quality in the market (or how the quality is perceived) is less straightforward: in fact, the conditions become more binding as the utility of non autograph works decreases or as the utility of autograph works decreases (*ceteris paribus*), meaning that in a market with pieces with a smaller difference between the value of autograph and non autograph will be less likely to

observe. Indeed, reducing $u(\overline{NA})$ or x means shrinking the distance between $u(\overline{A})$ and $u(\overline{NA})$,[4] so the consumer would perceive the two types of good more similar and would also expect a lower price threshold working as a price cap for the seller. Also, a lower x means a higher expected probability of having a non autograph and a consequent lower expected probability of having an autograph, as for (1).

A similar reasoning can be applied to the threshold on c, where we have:

$$
\begin{aligned}
\frac{\partial \tilde{c}}{\partial x} &< 0 \\
\frac{\partial \tilde{c}}{\partial u(\overline{NA})} &< 0 \\
\frac{\partial \tilde{c}}{\partial P_{NA}} &> 0 \ \text{if} \ x > \frac{\left(P_A + P_{NA}\right)\left(P_A - u(\overline{NA})\right)}{P_A u(\overline{NA})}
\end{aligned}
$$

In this case, the regulator might want the threshold on c to be higher, so that it is more likely that $c < \tilde{c}$ and, hence, the buyers collect information. To do so, it has to operate in a similar manner of the one we saw for $\tilde{P}_A$, namely reducing x and/or $u(\overline{NA})$ or increasing P_{NA}, even though in this case we have a condition on x, namely it has to be higher than a certain value.[5] The reasoning behind the influence on the c threshold is similar to the one we made above.

Clearly, not only a regulator would reason in this way, but also other sellers that operate in the same market: in fact, they might have the incentive to keep the market reliable, by preventing other sellers to behave opportunistically. They can do so by directly influencing the price of non autograph in the market or indirectly influencing the utility attached to the artworks, through an impact on $u(\overline{NA})$ and x. Since the art market is almost not regulated, the action of sellers is more likely to be observed than the one of a regulator.

So, in a market as the one our model depicts, a regulator or other sellers active in the market might take advantage of the existence of the thresholds on the cost of collecting information and of the price cap to limit the incentive to act in an opportunistic way of the seller. One way to do so would be to would be to increase the market price of non autograph works, all other parameters remaining the same; this may be attained by a general increase of the prices, being P_{NA} an average market price, and the more sellers increase their price, the more the effect can be observed on P_{NA}. An alternative action could regard the value of the artworks as perceived by the buyers: reducing $u(\overline{NA})$, that means reducing the value of both autograph and non autograph (with also a reduction of the difference between the two values), or reducing x, implying a decrease on the percentage gap between the two values, would act on the thresholds as well, narrowing the space of parameters for which the seller has incentive to behave opportunistically. This impact might be obtained either by reducing both the general quality of proposed autograph and non autograph artworks in the market, meaning a lower $u(\overline{NA})$, or by increasing (decreasing) the relative value of non autograph (autograph) works with respect to autograph works (non autograph works), hence a lower x.

Whereas regulating the setting of prices for autograph and non-autograph artworks could be an option to increase the buyers' protection from deceptive labeling practices, such a legal attempt might be relatively

---

[4]While this is straightforward for a change in x, notice that $u(\overline{A}) - u(\overline{NA}) = u(\overline{NA})(1 + x - 1) = u(\overline{NA})x$, so a lower $u(\overline{NA})$ means a lower difference between the two values.

[5]The condition on x exists even if the form of $\tilde{c}$ has no x in it, since these derivatives have been computed conditional on having $P_A \leq \tilde{P}_A$.

challenging to implement in practice. Regulators and policymakers should therefore be aware of several parameters when initiating the reflexive process and conceiving the draft bill. As (meta)-credence goods (Ekelund et al. 2020), the valuation of artworks depends on a series of objective and subjective criteria that prevent art market players from always predicting prices accurately or attaching a definitive value to an object, whose price is likely to fluctuate from one sale to another (Pesando 1993).

One of the most hardly definable parameters is the notion of artistic quality. Quality is not automatically correlated to authorship which means that non-autograph works can sometimes be more valuable than autograph ones, depending on the name and qualifier ascribed to the painting (Radermecker 2021). For ease of theoretical modelling, our demonstration relies on the assumption that autograph works are, on average, more expensive than non-autograph works. While this statement has been verified empirically, ceteris paribus, exceptions are regularly encountered in the art market. The category of non-autograph works also encompasses an heterogenous set of works that bear distinct attribution qualifiers used to dissociate different levels of supposed authorship, each of them affecting prices differently (Renneboog & Spaenjers 2013, Radermecker 2021). While the antinomic distinction between autograph and non-autograph works has proven its worth in prior research (Ginsburgh et al. 2019), this necessary simplification might complicate the setting of a price cap regulation.

The setting of an international regulatory environment, in which all auctioneers, art and antique dealers would align with common rules, is complicated by the fact that all these players do operate at the same market level and do not deal with the same category of goods. In this respect, considering the horizontal differentiation of the art market seems essential. Indeed, the use of autograph or non-autograph labels far exceeds the sole category of fine arts (paintings, sculpture, drawing), but also applies to other art objects and collectibles sold through less-investigated market segments (e.g., decorative art and furniture). The lack of knowledge on price formation mechanisms and information costs in these segments may prevent regulators and policymakers from capturing the economic idiosyncrasies of these objects and developing a consistent and cohesive regulation that suits each market segment's specificity. Similarly, the vertical differentiation of the art market should carefully be considered in the equation. The value attached to autograph and non-autograph works is likely to differ from the high-end to the middle- and lower-end parts of the art market, wherein objects of unequal quality are sold. The price difference between autograph and non-autograph on each market level should therefore be considered when setting the price cap. The standing and reputation of the sellers also greatly differ from one segment to another, as do their human and financial resources. Using a single price ratio to limit opportunistic behaviors when authenticating autograph and non-autograph artworks may therefore not be the most appropriate policy, calling for a more differentiated strategy.

Reputational markets also need a certain level of flexibility, adaptability, and responsiveness to be efficient (Devaney 2019). Since reattributions are commonplace in art history, a strict legal instrument regulating prices setting may not permit such flexibility. One could even argue that art market needs some grey areas to boost competition and bidding at auction, especially when dealing with works of art of an uncertain authorship. This argument is supported by Oosterlinck & Radermecker (2021) who show that prices are more competitive in markets where private governance prevails over regulation. The discovery of the "sleepers" – i.e., artworks whose prestigious authorship is still latent – is indeed what makes the market for non-autograph works appealing for certain buyers (Bandle 2016). Rigid price controls may affect the implicit

information conveyed by pre-sale estimates and alter the buyer's ability to detect good deals. Another potential objection to national and/or transnational regulation, already pointed out by Ranchordás (2019) and Adamska & Dabrowski (2015), is the impossibility for government officers and public authorities to inspect each sale and auction organized in their domestic market. All countries should not only comply with it but also adopt local policies to make the convention or directive fully effective (De Silva et al. 2012). The implementation of such controlling measures is expensive and requires an efficient state apparatus that might not be a current priority for governments.

With these considerations in mind, future research should further consider the possibility of regulating the authentication process of artworks through price setting, by exploring the potential advantages and disadvantages of harmonizing price caps through national and/or international regulation.

4   Conclusion

In this paper, we explore labeling strategies in markets trading credence goods and characterized by asymmetric information, in particular art market. Labeling can serve as a signal to the market about the good's quality and to some extent solve the information asymmetry. We develop a theoretical model that explains the choices the sellers make between labeling the artwork as autograph (A) and non-autograph (NA) work, and the resulting price setting strategies. Non-autograph artworks (i.e., whose authorship is unknown) represent significant proportion of auctioned credence goods leading to additional cases of market failure and the scope for label manipulation. Our theoretical model considers artworks as credence goods and takes into account a set of exogenous and endogenous forces suspected to explain the correlation between the choice of a particular labeling strategy and the final price (e.g., quality, research costs, etc.). By looking at the sellers' and buyers' choices, we are able to understand some of the auction houses' incentives/constraints to opt for one label over another (A/NA). Our model shows the various possible scenarios art market intermediaries face with when dealing with works of art. Assuming that the price of A works is higher than that of NA works, we show that honest strategy regarding a work's actual nature might be more profitable for the seller in most of the cases.

We also find the necessary condition for mislabeling an artwork which is the high costs of verifying its quality. The uncertainty about the quality when the verification is not done introduce an endogenous price cap for autograph artworks. Misattributions are not rare for the art market, and later reattributions affect the prices on the market (Etro & Stepanova 2021) leading to buyers' cautiousness in the market with potentially misattributed works. Existence of the price cap may suggest the direction of the potential regulatory actions to reduce the opportunistic behavior of the sellers. However, implementation of a price cap regulation is not immediately straightforward, and a certain degree of differentiation towards the type of artworks is necessary.

This paper has direct implications for art market players relating to the choice optimal naming strategy. However, our model and setting can be further extended to other market of credence and experience goods, for example, the markets of old wines, antiques, collectibles, and similar. Moreover, similar model may contribute to the discussion of the optimal approach to avoid the circulation of fakes (Scorcu et al. 2021).

Acknowledgement

References

Aaker, D. A. (1992), 'The value of brand equity', *Journal of Business Strategy* **13**(4), 27–32.

Aaker, D. A. (1996), *Building Strong Brands*, New York: Free Press.

Aaker, J. L. (1997), 'Dimensions of brand personality', *Journal of Marketing Research* **34**(3), 347–356.

Adamska, A. & Dabrowski, T. J. (2015), 'reputation and regulations as market and non-market mechanisms to reduce bifurcated risk', *Ekonomia i Prawo. Economics and Law* **14**(2), 155–168.

Akerlof, G. A. (1970), 'The market for 'Lemons': Quality uncertainty and the market mechanism', *The Quarterly Journal of Economics* **84**(3), 488–500.

Angelini, F. & Castellani, M. (2021), Art market stakeholders' actions and strategies for the co-creation of artists' brands, *in* E. Lazzaro, N. Moureau & A. Turpin, eds, 'Researching Arts Markets: Past, Present and Tools for the Future', London: Routledge.

Angelini, F., Castellani, M. & Pattitoni, P. (2019), 'Artist names as human brands: Brand strategies in the Italian gallery art market'. Available at SSRN: https://ssrn.com/abstract=3495474.

Ashenfelter, O. & Graddy, K. (2003), 'Auctions and the price of art', *Journal of Economic Literature* **41**(3), 763–787.

Ashenfelter, O. & Graddy, K. (2005), 'Anatomy of the rise and fall of a price-fixing conspiracy: Auctions at sotheby's and christie's', *Journal of Competition Law and Economics* **1**(1), 3–20.

Ashenfelter, O. & Graddy, K. (2011), 'Sale rates and price movements in art auctions', *American Economic Review* **101**(3), 212–216.

Bakos, Y. & Dellarocas, C. (n.d.), 'Cooperation without enforcement? a comparative analysis of litigation and online reputation as quality assurance mechanisms', *Management Science* **57**(11), 1944–1962.

Baltzer, K. (2011), 'Standards vs. labels with imperfect competition and symmetric information', *Economic Letters* **114**(1), 61–63.

Bandle, A. L. (2016), *The sale of misattributed artworks and antiques at auction*, Edward Elgar Publishing.

Bauwens, L. & Ginsburgh, V. (2000), 'Art experts and auctions are pre-sale estimates unbiased and fully informative?', *Recherches Economiques de Louvain/Louvain Economic Review* **66**(2), 131–144.

Beckert, J. (2020), 'Markets from meaning: Quality uncertainty and the intersubjective construction of value', *Cambridge Journal of Economics* **44**, 285–301.

Beckert, J. & Rössel, J. (2013), 'The price of art. Uncertainty and reputation in the art field', *European Societies* **15**(2).

Beggs, A. & Graddy, K. (1997), 'Afternoon effect: Evidence from art auctions', *The RAND Journal of Economics* **28**(3), 544–565.

Beggs, A. & Graddy, K. (2008), 'Failure to meet the reserve price: The impact on returns to art', *Journal of Cultural Economics* **32**, 301–320.

Bonroy, O. & Constantatos, C. (2008), 'On the use of labels in credence goods markets', *Journal of Regulatory Economics* **33**, 237–252.

Bonroy, O. & Constantatos, C. (2015), 'On the economics of labels: How their introduction affects the functioning of markets and the welfare of all participants', *American Journal of Agricultural Economics* **97**(1), 239–259.

Bonroy, O., Lemari, S. & Tropéano, J.-P. (2013), 'Credence goods, experts, and risk aversion', *Economic Letters* **120**(3), 464–467.

Castellani, M., Pattitoni, P. & Scorcu, A. E. (2018), 'On the relationship between reserve prices and low estimates in art auctions', *Journal of Cultural Economics* **42**(1), 45–56.

Chakraborty, A. & Harbaugh, R. (2010), 'Persuasion by cheap talk', *American Economic Review* **100**(5), 2361–2382.

Coffman, R. B. (1991), 'Art investment and asymmetrical information', *Journal of Cultural Economics* **15**(2), 83–94.

Crawford, V. P. & Sobel, J. (1982), 'Strategic information transmission', *Econometrica* **50**(6), 1431–1451.

Crespi, J. M. & Marette, S. (2001), 'How should food safety certification be financed?', *American Journal of Agricultural Economics* **83**(4), 852–861.

Czujack, C. & Martins, M. F. (2004), 'Do art specialists form unbiased pre-sale estimates? an application for Picasso paintings', *Applied Economics Letters* **11**(4), 245–249.

da Silva, T. M. F. (2015), '19 usc section 1595a (c), the forfeiture powers of the united states government, and their effects on art market entities', *Quinnipiac L. Rev.* **34**, 411.

Darby, M. R. & Karni, E. (1973), 'Free competition and the optimal amount of fraud', *Journal of Law and Economics* **16**, 67–88.

De Silva, D., Pownall, R. & Wolk, L. (2012), 'Does the sun shine on art prices?', *Journal of Economic Behavior & Organization* **82**, 167–178.

Dempster, A. M. (2014), *Risk and Uncertainty in the Art World*, London: Bloomsbury.

Devaney, S. (2019), 'Enhancing the international regulation of science innovators: reputation to the rescue?', *Law, Innovation and Technology* **11**(1), 134–154.

Dziuda, W. (2011), 'Strategic argumentation', *Journal of Economic Theory* **46**(4), 1362–1397.

Ekelund Jr, R. B., Jackson, J. D. & Tollison, R. D. (2013), 'Are art auction estimates biased?', *Southern Economic Journal* **80**(2), 454–465.

Ekelund, R. B., Higgins, R. & Jackson, J. D. (2020), 'ART as meta-credence: Authentication and the role of experts', *Journal of Cultural Economics* **44**, 155–171.

Ekelund, R. B., Mixon, F. G. & Ressler, R. W. (1995), 'Advertising and information: An empirical study of search, experience, and credence goods', *Journal of Economic Studies* **22**(2), 33–43.

Ekelund, R. B., Ressler, R. W. & Watson, J. K. (1998), 'Estimates, bias, and "no sales" in Latin-American art auctions, 1977-1996', *Journal of Cultural Economics* **22**, 33–42.

Ekelund, R. B. & Thornton, M. (2019), 'Extreme credence and imaginary goods', *Atlantic Economic Journal* **47**(3), 361–371.

Etro, F. & Stepanova, E. (2021), 'Art return rates from old master paintings to contemporary art', *Journal of Economic Behavior & Organization* **181**, 94–116.

Euwe, J. & Oosterlinck, K. (2017), 'Art price economics in the Netherlands during World War II', *Journal for Art Market Studies* **1**(1), 47–67.

Fincham, D. (2017), 'Authenticating art by valuing art experts', *Mississippi Law Journal* **86**, 567–628.

Flandreau, M. & Flores, J. H. (2009), 'Bonds and brands: Foundations of sovereign debt markets, 1820–1830', *The Journal of Economic History* **69**(3), 646–684.

Frey, B. S. & Eichenberger, R. (1995), 'On the return of art investment return analyses', *Journal of Cultural Economics* **19**(3), 207–220.

Gentner, D. (1983), 'Structure-mapping: A theoretical framework for analogy', *Cognitive Science* **7**(2), 155–170.

Giannakas, K. (2002), 'Information asymmetries and consumption decisions in organic food product markets', *Canadian Journal of Agricultural Economics* **50**, 35–50.

Ginsburgh, V. A. & van Ours, J. C. (2003), 'Expert opinion and compensation: Evidence from a musical competition', *American Economic Review* **93**(1), 289–296.

Ginsburgh, V., Radermecker, A.-S. & Tommasi, D. (2019), 'The effect of experts' opinion on prices of art works: The case of Peter Brueghel the Younger', *Journal of Economic Behavior & Organization* **159**, 36–50.

Goetzmann, W. N. (1995), 'The informational efficiency of the art market', *Managerial Finance* **21**(6), 25–34.

Goldin, C. & Rouse, C. (2000), 'Orchestrating impartiality: The impact of "blind" auditions on female musicians', *American Economic Review* **90**(4), 715–741.

Herbig, P. & Milewicz, J. (1995), 'The relationship of reputation and credibility to brand success', *Journal of Consumer Marketing* **12**(4), 5–10.

Hernando, E. & Campo, S. (2017), 'Does the artist's name influence the perceived value of an art work?', *International Journal of Arts Management* **19**(2), 46–58.

Holt, D. B. (2004), *How Brands Become Icons*, Boston, MA: Harvard Business School Press.

Kapferer, J.-N. (1997), *Strategic Brand Management. Creating and Sustaining Brand Equity Long Term*, London: Kogan Page.

Keller, K. L. (1998), *Strategic Brand Management: Building, Measuring, and Managing Brand Equity*, Upper Saddle River, NJ: Prentice-Hall.

Kerrigan, F., Brownlie, D., Hewer, P. & Daza-LeTouze, C. (2011), 'Spinning Warhol: Celebrity brand theoretics and the logic of the celebrity brand', *Journal of Marketing Management* **27**(13/14), 1504–24.

Kirmani, A. & Rao, A. R. (2000), 'No pain, no gain: A critical review of the literature on signaling unobservable product quality', *Journal of Marketing* **64**(2), 66–79.

Kreps, D. M. & Wilson, R. (1982), 'Reputation and imperfect information', *Journal of Economic Theory* **27**(2), 253–279.

Lazzaro, E. (2006), 'Assessing quality in cultural goods: The hedonic value of originality in Rembrandt's prints', *Journal of Cultural Economics* **30**(1), 15–40.

Lupton, S. (2005), 'Shared quality uncertainty and the introduction of indeterminate goods', *Cambridge Journal of Economics* **29**(3), 399–421.

Macey, J. (2010), 'The value of reputation in corporate finance and investment banking (and the related roles of regulation and market efficiency)', *Journal of Applied Corporate Finance* **22**(4), 18–30.

Marcus Decree (1981), 'Décret n. 81-255 du 3 mars 1981 sur la répression des fraudes en matière de transactions d'œuvres d'art et d'objets de collection. Modifications made by Décret n. 2001-650 du 19 juillet 2001'. Retrieved at https://www.legifrance.gouv.fr/loda/id/JORFTEXT000000684875/2001-09-30, accessed on 19 August 2021.

Marrone, J. & Beltrametti, S. (2020), '"sleeper" antiquities: Misattributions in sales of ancient art', *International Journal of Cultural Property* **27**(1), 3–51.

McAndrew, C., Smith, J. L. & Thompson, R. (2012*a*), 'The impact of reserve prices on the perceived bias of expert appraisals of fine art', *Journal of Applied Econometrics* **27**(2), 235–252.

McAndrew, C., Smith, J. L. & Thompson, R. (2012*b*), 'The impact of reserve prices on the perceived bias of expert appraisals of fine art', *Journal of Applied Econometrics* **27**(2), 235–252.

Mei, J. & Moses, M. (2005), 'Vested interest and biased price estimates: Evidence from an auction market', *The Journal of Finance* **60**(5), 2409–2435.

Milgrom, P. R. (1981), 'Rational expectations, information acquisition, and competitive bidding', *Econometrica* **49**(4), 921–943.

Milgrom, P. R. & Roberts, J. (1986), 'Price and advertising signals of product quality', *Journal of Political Economy* **94**(4), 796–821.

Milgrom, P. R. & Weber, R. J. (1982), 'A theory of auctions and competitive bidding', *Econometrica* **50**(5), 1089–1122.

Monroe, K. (1973), Buyers' subjective perception of price, *in* H. H. Kassarjian & T. S. Robertson, eds, 'Perspectives in Consumer Behaviours', Glenview, IL: Scott Foresman, pp. 23–42.

Mossetto, G. & Vecco, M., eds (2004), *The Economics of Copying and Counterfeiting*, Milan: Franco Angeli.

Moulin, R. (1992), *L'artiste, l'institution et le marché*, Paris: Flammarion.

Moulin, R. (2009), *Le marché de l'art: mondialisation et nouvelles technologies*, Paris: Flammarion.

Moulin, R. & Quemin, A. (1995), Experts et expertises. la certification de la valeur de l'art, *in* R. Moulin, ed., 'De la valeur de l'art', Paris: Flammarion, pp. 236–265.

Muñiz, A., Norris, T. & Fine, G. (2014), 'Marketing artistic careers: Pablo picasso as brand manager', *European Journal of Marketing* **48**(1), 68–88.

Nelson, P. (1970), 'Information and consumer behavior', *Journal of Political Economy* **78**(2), 311–329.

Nelson, P. (1974), 'Advertising as information', *Journal of Political Economy* **82**(2), 729–754.

Oczkowski, E. (2021), 'The catalogue raisonné and art auction prices: the case of Berthe Morisot', *Empirical Economics* **61**, 1669–1687.

Onofri, L. (2009), 'Old master paintings, export veto and price formation: An empirical study', *European Journal of Law Economics* **28**(2), 149–161.

Oosterlinck, K. (2017), 'Art as a wartime investment. Conspicuous consumption and discretion', *The Economic Journal* **127**(607), 2665–2701.

Oosterlinck, K. & Radermecker, A.-S. (2019), '"The Master of ...": Creating names for art history and the art market', *Journal of Cultural Economics* **43**, 57–95.

Oosterlinck, K. & Radermecker, A.-S. (2021), 'Regulation or reputation? Evidence from the art market'. Working Papers CEB 21-006, ULB – Universite Libre de Bruxelles.

Pesando, J. E. (1993), 'Art as an investment: The market for modern prints', *The American Economic Review* pp. 1075–1089.

Png, I. & Reitman, D. (1995), 'Why are some products branded and others not?', *Journal of Law and Economics* **38**(1), 207–224.

Preece, C. & Kerrigan, F. (2015), 'Multi-stakeholder brand narratives: an analysis of the construction of artistic brands', *Journal of Marketing Management* **31**(11/12), 1–24.

Preece, C., Kerrigan, F. & O'Reilly, D. (2016), 'Framing the work: the composition of value in the visual arts', *European Journal of Marketing* **50**(7/8), 1377–1398.

Radermecker, A.-S. (2019), 'Artworks without names: an insight into the market for anonymous paintings', *Journal of Cultural Economics* **43**(3), 443–483.

Radermecker, A.-S. (2020), 'The market reception of 'new connoisseurship': The impact of recent advances in art scholarship on the selling and buying of early Flemish paintings', *Nederlands Kunsthistorische Jaarboek. Art and the Knowledge of Connoisseurship/Kennerschap en Kunst* **69**, 339–372.

Radermecker, A.-S. (2021), *Anonymous Art at Auction. The Reception of Early Flemish Paintings in the Western Art Market*, Studies in the History of Collecting & Art Market 11, Leiden/Boston: Brill.

Ranchordás, S. (2019), 'Public values, private regulators: Between regulation and reputation in the sharing economy', *Law & Ethics of Human Rights* **13**(2), 203–237.

Renneboog, L. & Spaenjers, C. (2013), 'Buying beauty: On prices and returns in the art market', *Management Science* **59**(1), 36–53.

Roe, B. & Sheldon, I. (2007), 'Credence good labeling: The efficiency and distributional implications of several policy approaches', *American Journal of Agricultural Economics* **89**(4), 1020–1033.

Schroeder, J. E. (2005), 'The artist and the brand', *European Journal of Marketing* **39**(11), 1291–1305.

Schroeder, J. E. (n.d.), 'Andy Warhol: Consumer researcher', *Advances in Consumer Research* **24**(1), 476–482.

Scorcu, A. E., Vici, L. & Zanola, R. (2021), 'To fake or not to fake: An empirical investigation on the fine art market', *Journal of Cultural Economics* **45**(1), 143–152.

Shi, X. (2013), 'Common-value auctions with asymmetrically informed bidders and reserve price', *International Journal of Economic Theory* **9**(2), 161–175.

Shin, H. S. (1994), 'The burden of proof in a game of persuasion', *Journal of Economic Theory* **64**(1), 253–264.

Shortland, A. & Shortland, A. (2020), 'Governance under the shadow of the law: Trading high value fine art', *Public Choice* **184**(1), 157–174.

Small, Z. (2021), 'Congress poised to apply banking regulations to antiquities market'. The New York Times, retrieved at https://www.nytimes.com, accessed on 7 January 2021.

Spence, M. (1973), 'Job market signaling', *The Quarterly Journal of Economics* **87**(3), 355–374.

Spence, M. (1974), 'Competitive and optimal responses to signals: An analysis of efficiency and distribution', *Journal of Economic Theory* **7**(3), 296–332.

Spencer, R. D., ed. (2004), *The Expert versus the Object: Judging Fakes and False Attributions in the Visual Arts*, Oxford: Oxford University Press.

Stigler, G. J. (1961), 'The economics of information', *Journal of Political Economy* **69**, 213–225.

Teisl, M. F. & Roe, B. E. (1998), 'The economics of labeling: An overview of issues for health and environmental disclosure', *Agricultural and Resource Economics Review* **27**(2), 140–50.

Van Horen, F. & Pieters, R. (2013), 'Preference reversal for copycat brands: Uncertainty makes imitation feel good', *Journal of Economic Psychology* **37**, 54–64.

Velthuis, O. (2005), *Talking prices: Symbolic meanings of prices on the market for contemporary art*, Princeton, NJ: Princeton University Press.

Walley, M. J. & Fortin, D. R. (2005), 'Behavioral outcomes from online auctions: reserve price, reserve disclosure, and initial bidding influences in the decision process', *Journal of Business Research* **58**(10), 1409–1418.

Weigelt, K. & Camerer, C. (1988), 'Reputation and corporate strategy: A review of recent theory and applications', *Strategic Management Journal* **9**(5), 443–454.

Wolinsky, A. (1983), 'Prices as signals of product quality', *The Review of Economic Studies* **50**(4), 647–658.

Worthington, A. C. & Higgs, H. (2004), 'Art as an investment: Risk, return, and portfolio', *Accounting and Finance* **44**(2), 257–271.