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Price and information disclosure in the private art market: a signalling game

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Highlights

- We study the equilibrium in a 1-to-1 exchange in the private art market in presence of two sources of asymmetric information
- Buyer's uncertainty concerns quality of the artwork, seller's uncertainty concerns buyer's knowledge
- We identify a series of equilibria, which do not seem to benefit the non-expert buyer
- One of these equilibria is a "counter-lemon" equilibrium, where low quality and non-expert buyers are excluded from the market

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Price and information disclosure in the private art market: a signalling game

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Abstract

In this paper, we model private art market agents' strategic interactions in presence of two types of asymmetric information, about artwork quality and buyer's knowledge, assuming the seller does not know how informed is the buyer while the buyer does not know the quality of the artwork before purchase. If the seller can choose either a high or a low price and the buyer can signal his type to the seller, we identify the conditions for both equilibria with pooling buyer signalling strategy and with separating strategy, as well as conditions for equilibria where the seller fixes the price according to the actual quality and where he posts prices trying to take advantage of buyer's limited information. Finally, we identify the condition for the emergence of a "counter-lemon" result, where low-quality artworks and uninformed collectors exit the market, suggesting that seller uncertainty does not directly benefit the buyers, but it can impact the quality traded in the market.

JEL Codes: Z11, C7, D82

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1. Introduction

Among markets characterised by asymmetric information issues, there are surely art markets, where cultural goods are traded. These goods feature a hard-to-evaluate quality and a multi-dimensional value (McCain, 1980), made up of an economic value, strictly related to their prices, and a cultural value, which influences the former but can also be evaluated in a non-market setting (Angelini & Castellani, 2019). Price formation of cultural goods is then influenced by these characteristics and by the interaction between the agents operating in the art market and with other stakeholders interplay who can have an active role in the art world without being part of the trades (Angelini & Castellani, 2021).

Concerning pricing mechanisms, the existence of asymmetric information could generate misbehaviour and opportunistic choices in the hands of those who hold superior information, who are generally the sellers (Akerlof, 1970); in fact, collectors who are not knowledgeable of the market could end up with misattributed or fake artworks (Radermecker et al., 2021), paying for a higher-valued artwork, being unable to identify the actual quality.

In this framework, we want to study how asymmetric information framework interacts with price setting in the private art market, where galleries and art dealers mainly sell to private collectors.[1] In this market, price is formed through "haggling" (Velthuis, 2011), i.e., a bargaining process on the discount of price between the buyer and the seller, following the dealer posting a price for an artwork. While the actual discount is private information and depends on the market power of the two parts, it is interesting to study the price formation considering the type of buyer the seller faces: in particular, it is likely that when a knowledgeable buyer is offered a low-quality artwork as if it were a high-quality one, he can recognize it after purchase and ask for reimbursement, as in an experience good market with guarantees, while when a less informed buyer wants

[1] See Velthuis (2002) for a discussion on public and private prices in the art market.

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to buy the same artwork, he has to rely on quality signals, but like in credence good markets, the quality is never actually known by the consumer (even after purchase).[2] In this paper, using a standard framework in cultural economics, we consider two different types of collectors: "insider" collector to refer to an informed buyer and "outsider" collector to indicate a less informed collector.[3]

Recently, cultural economics research focused on identifying a cultural good as either credence or experience good (or as other types of good), depending on the information available to the agents and the particular features of each cultural good.[4] For example, both Blaug (2001) and Krueger (2005) state that cultural goods are experience goods, suggesting that "a temporal process of consumption" is needed to understand the quality of the good and know the utility derived from its consumption. Others scholars suggest that cultural goods are credence goods, meaning that their quality cannot be identified by the buyer but is known to the seller, or even "meta-credence" goods, for which their quality cannot be identified by neither the seller nor the buyer (Ekelund et al., 2020). For the contemporary art market, Zorloni (2013) introduces the concept of "trust good, whose quality is not assessable by the buyer neither before nor after purchase due to lack of technical and cultural knowledge". In this vein, Bonus & Ronte (1997) define "cultural quality" which can be evaluated only thanks to a very specific type of cultural knowledge. Finally, Caves (2003) asserts that "in creative industries *nobody knows*, and the core problem is one of symmetrical ignorance", while Lupton (2005) posits the concept of "indeterminate good", whose quality is uncertain for everyone, though for the artworks the artist alone knows the quality.

The salience of these types of goods can be observed both in the high-end

[2]See Stigler (1961), Nelson (1970), and Darby & Karni (1973) for the definition of search, experience, and credence goods.

[3]Baumol (1986) states that in the art market there are two kinds of collectors, those who are "people who understand art" (insider collectors), and those who behave like an "amateur who does not know what he is doing" (outsider collectors). See also Bonus & Ronte (1997).

[4]It has to be highlighted that, for certain types of agents in the art market, such as critics and experts, artworks appear more like search goods.

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and in the low-end art market, but the sales in the high-end market, such as fine arts and luxury goods, are mostly intermediated by auction houses, while the sales in the low-end, regarding for example ethnic and tribal art, prints and collectibles, etc., are mainly intermediated by galleries and art dealers. In this private information context characterised by asymmetric information, signals of quality become particularly important for the buyers (Wolinsky, 1983; Candela et al., 2012). Among these signals, the most important are the artwork price (Throsby, 2001), the artist's talent and fame (Rosen, 1981; Adler, 1985; Candela et al., 2016b), and the artist human brand (Schroeder, 2005; Zorloni, 2005; Muñiz Jr. et al., 2014; Preece & Kerrigan, 2015; Hernando & Campo, 2017; Angelini et al., forthcoming). However, the use of these signals interacts with the pricing strategy of the sellers and with the choices of the collectors (Radermecker et al., 2021), which also depend on market power and on how innovative is the artist traded, on the knowledge the buyer has of the art market (Brito & Barros, 2005; Champarnaud, 2014; Di Gaetano et al., 2019), and on the market channel in which the gallery is located (Cellini & Cuccia, 2014; Angelini & Castellani, 2018).

The co-existence of asymmetric information issues, agents' strategic choices, and imperfect signals that we illustrated so far, are the features of a complex market where adverse selection and opportunistic behaviour are likely to emerge (Akerlof, 1970). In the case of asymmetric information, the role of signals on quality has been studied within the ethnic art market (Candela et al., 2012) and within adverse selection models (Palazzo, 2017), while Radermecker et al. (2021) studied the role of signals on price formation in presence of (possibly) misattributed and fake artworks. However, in the cultural economics literature there is no focus on the strategy a buyer can follow in disclosing fake information about himself, mimicking a higher knowledge of the market when facing the seller. This type of strategy is limited to 1-to-1 transactions where bargaining is (possibly) at work since an auction mechanism would get rid of any possible

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incentive for the buyer to misdisclose his status to the information holder.[5]

In this paper, we develop an art market signalling model assuming that two types of collectors exist, an informed type (insider) and an uninformed type (outsider), and that the dealer cannot identify the type of buyer before trading. We assume that an additional (and usually observed in the art market) asymmetric information issue is present, namely the dealer knows the artwork quality before trading, while the insider collector does not before trading but can know it after purchase, while the outsider collector can never inspect the quality because is too costly. In our model, the buyer can signal his type to the seller, possibly misdisclosing it to take advantage of the sellerâĂŹs uncertainty and possibly sustaining a cost. Depending on this strategic choice and on the price posted by the seller, we identify the condition for pooling and separating equilibria about the disclosure of the type of the buyer, showing that the introduction of uncertainty in the buyer's type does not seem to benefit the outsider collectors. However, we find that a "counter-lemon" equilibrium exists, in which the low quality and the outsider collectors exit the market.

Our paper contributes to the literature on the role of information asymmetries in private art markets, taking into account the previously unexplored possibility of misdisclosure of the information held by the collector when interacting with a private art dealer. Our model also adds to the previous studies on the private art market and on the price formation within it (e.g., Peterson, 1997; Benhamou et al., 2002; Velthuis, 2003; Schönfeld & Reinstaller, 2007) by considering how a new type of uncertainty can shape the pricing strategies of an art private dealer.

The remainder of the paper is organized as follows. In Section 2, we develop the model of pricing in presence of asymmetric information on both the seller and the buyer side. Section 3 discusses the results and Section 4 concludes.

[5]Moreover, assuming that the seller can identify the type of the buyer, the signal he can send by posting a price would not be effective, since the outsider collector cannot process it and the insider would not believe it. Hence, transactions where there is an outsider collector will concern only low-quality pieces, while the market would work without distortions for insiders, in case they can check the quality after purchase, as we assumed.

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2. The game model

The seller in our model is a private art dealer (D), while the buyer (B) can either be an insider (I) or an outsider (O). Each agent has a different level of information at his disposal and can use it to evaluate the quality of the artwork. The dealers detain information about what they are selling. Insider collectors are informed and experienced collectors who know how to value artworks, but they need time to do that, so we assume they cannot do it in an accurate way before purchase. The outsider collectors are uninformed collectors, with little or no knowledge of the mechanisms of the art market. We assume this last group is made up of agents who cannot know the artwork quality even after purchase, because detecting the quality is too costly for them and they cannot consult an expert who can evaluate quality for them.

Hereafter, we assume that both types of collectors can observe the posted price, but only the insider collectors can ascertain the quality of the artwork after purchase and discover if their expectations on quality were correct. If this is not the case, i.e., if the artwork quality is lower than the one signalled through the posted price, we assume that the insider can ask for reimbursement, generating a cost for the seller greater than the paid price.[6] We further assume that the outsider collector, knowing that insider collectors exist and that they can check for quality and potentially ask for reimbursement, can mimic the insider

[6]The additional cost that adds to the actual reimbursement of the price can be due, for example, to reputation costs for the seller, and/or to actual compensation for damage. From a legal point of view, when a buyer discovers that a purchased artwork is fake, he will be entitled to a refund of the amount paid and compensation for damage. In Italy, according to the Supreme Court, the seller in such cases would be required not only to repay the sums received but also to pay the legal interest accrued from the day the price was paid. As for the compensable damage, it consists of the greater value (unrealizable for the buyer) that the artwork would have achieved over time if it had been authentic (Tacente, 2013). Commercial contracts can contain express termination clauses which provide for contractual termination when certain specified circumstances occur. These contractual termination clauses indicate expressly terms as conditions or warranties as circumstances in which the contract can be brought giving a right to claim damages (Randall, 2014). Under Italian law, the express termination clause provided for in article 1456 of the Italian Civil Code allows for the immediate termination of a contract if a specified obligation is not fulfilled as agreed. For recent issues about art law, see also Liberati Buccianti (2018).

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collector in the interaction with the dealer, by incurring a cost,[7] in order to generate uncertainty in the dealer's hands.

We assume that the dealer obtains an artwork playing a game with nature (N), where N chooses the artwork quality q, with $q = L, H$ and $L < H$. The dealer sustains a cost equal to C_q, with $q = L, H$ and $C_H > C_L \geq 0$. We assume the dealer perfectly knows q, while the insider collector will get to know q only after purchase and the outsider collector cannot know q.

Once the dealer obtained the artwork, we assume that he meets a buyer, without knowing a priori his type t, namely if he is an insider ($t = I$) or an outsider ($t = O$). The buyer can signal his type to the seller, being honest or not: both types of buyers can costlessly choose their signalled type $\tilde{t}$ between $\tilde{I}$ or $\tilde{O}$, besides the case in which the outsider chooses $\tilde{t} = \tilde{I}$ where he would incur a cost $c > 0$.

The dealer, assumed to be risk-neutral, observes the signalled type $\tilde{t}$ and then posts a price p, choosing between p_H and p_L, with $p_H \geq C_H > p_L \geq C_L \geq 0$. We assume that both prices are exogenously given to the seller since they are fixed with a mark-up rule based on the cost C_q, which are likewise exogenous to the seller (Candela et al., 2016a). The choice among the two prices will be based on conditional probabilities the seller attaches to meet a certain type t given the declared type $\tilde{t}$, namely: $Prob(I|\tilde{I}) = \varphi$, $Prob(O|\tilde{I}) = 1 - \varphi$, $Prob(I|\tilde{O}) = \theta$, and $Prob(O|\tilde{O}) = 1 - \theta$.[8] The chosen price can be then observed by the buyer, who faces the choice on trading tr, having to choose between buying the piece ($tr = b$) and not buying it ($tr = nb$) at the price chosen by the seller. In case $q = L$, $t = I$, $p = p_H$, and $tr = b$, the buyer can ask for reimbursement and we assume that the seller cannot deny the request and would incur a total cost equal to $(1+k)p_H$, with $k > 0$, given by the reimbursed price and an additional

[7] The outsider collector could spend time and/or money to collect information that helps him appear as an insider. Notice, however, that this information does not constitute the knowledge needed to identify the quality of the artwork after purchase.

[8] We assume that $\theta < \varphi$, namely $Prob(O|\tilde{O}) > Prob(O|\tilde{I})$, since the seller is aware that choosing $\tilde{I}$ is costly for the outsider.

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cost equal to kp_H.

Both types of collectors are risk-neutral and they will base their strategic choice also on the probability (ϕ) of having q being equal to H, that is assumed to be $0 < \phi < 1$. After purchase, the utility of the insider, when he buys the artwork and the reimbursement conditions are not met, would be equal to $u(q)$, with $q = L, H$, with $u(H) \geq p_H$, $u(L) \geq p_L$, and $u(H) > u(L)$, while the outsider's utility would be equal to $u(E(q))$ independently on q, with $u(E(q)) < p_H$. We further assume that the seller does not know the utility of the buyers, but he knows that $u(E(q))$ is uniformly distributed over the interval $(0, \tilde{u})$, with $\tilde{u} \geq p_H$.[9]

The timing of the game is then:

1. D receives from nature (N) a good of quality q, sustaining a cost equal to C_q, with $q = L, H$.
2. D meets B, whose type is t.
3. B chooses the type $\tilde{t}$ he wants to signal to D, potentially incurring a cost c.
4. D observes $\tilde{t}$ and fixes p.
5. B observes p and decides if he wants to buy the artwork ($tr = b$) or not ($tr = nb$).
6. if $q = H$, $t = I$, $p = p_H$, and $tr = b$, the buyer asks for reimbursement and gets it, while the seller gives back the paid money to the buyer and further incurs a cost equal to kp_H.
7. payoffs are observed.

[9] Hereafter, we assume that $p_L < p_H \left(1 - \frac{(1-\theta)p_H}{\tilde{u}}\right)$, to keep out strategies where the seller chooses a low price for high-quality artworks.

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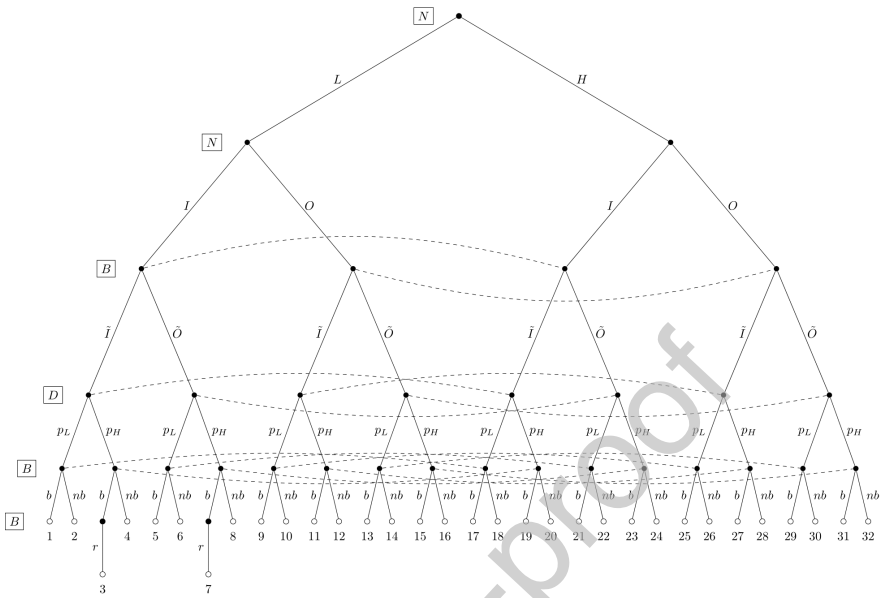

Figure 1: Extensive form of the game

Figure 1 reports the extensive form of the game,[10] while Table 1 reports the payoffs of each end node of the game.

Solving the game backwards, we can notice that, in step 5, strategy b dominates nb every time $p = p_L$, independently on q, t, and $\tilde{t}$. Comparing the buyer's payoffs and considering the probability ϕ, we have that the insider who declared himself as an insider ($\tilde{t} = \tilde{I}$) and observes $p = p_H$ will have the strategy nb dominated by b; the same relationship between the two strategies is also observed when he declares himself as an outsider, so nb is dominated also when $\tilde{t} = \tilde{O}$ and $p = p_H$. Considering the case of the outsider and $p = p_H$, we have that b is dominated by nb both when he declares himself as an outsider and when he declares himself as an insider, since $u(E(q)) < p_H$.

Let's analyse now step 4 of the game. Consider the case $q = L$ and recall that the seller only knows $\tilde{t}$ before making his choice on p. When the seller observes

[10] In Figure 1, we indicated with r the request of reimbursement made by the insider collector.

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End node n.	q	t	$\tilde{t}$	p	tr	payoff B	payoff D
1	L	I	$\tilde{I}$	p_L	b	$u(L) - p_L$	$p_L - C_L$
2	L	I	$\tilde{I}$	p_L	nb	0	$-C_L$
3	L	I	$\tilde{I}$	p_H	b	0	$-kp_H - C_L$
4	L	I	$\tilde{I}$	p_H	nb	0	$-C_L$
5	L	I	$\tilde{O}$	p_L	b	$u(L) - p_L$	$p_L - C_L$
6	L	I	$\tilde{O}$	p_L	nb	0	$-C_L$
7	L	I	$\tilde{O}$	p_H	b	0	$-kp_H - C_L$
8	L	I	$\tilde{O}$	p_H	nb	0	$-C_L$
9	L	O	$\tilde{I}$	p_L	b	$u(E(q)) - p_L - c$	$p_L - C_L$
10	L	O	$\tilde{I}$	p_L	nb	$-c$	$-C_L$
11	L	O	$\tilde{I}$	p_H	b	$u(E(q)) - p_H - c$	$p_H - C_L$
12	L	O	$\tilde{I}$	p_H	nb	$-c$	$-C_L$
13	L	O	$\tilde{O}$	p_L	b	$u(E(q)) - p_L$	$p_L - C_L$
14	L	O	$\tilde{O}$	p_L	nb	0	$-C_L$
15	L	O	$\tilde{O}$	p_H	b	$u(E(q)) - p_H$	$p_H - C_L$
16	L	O	$\tilde{O}$	p_H	nb	0	$-C_L$
17	H	I	$\tilde{I}$	p_L	b	$u(H) - p_L$	$p_L - C_H$
18	H	I	$\tilde{I}$	p_L	nb	0	$-C_H$
19	H	I	$\tilde{I}$	p_H	b	$u(H) - p_H$	$p_H - C_H$
20	H	I	$\tilde{I}$	p_H	nb	0	$-C_H$
21	H	I	$\tilde{O}$	p_L	b	$u(H) - p_L$	$p_L - C_H$
22	H	I	$\tilde{O}$	p_L	nb	0	$-C_H$
23	H	I	$\tilde{O}$	p_H	b	$u(H) - p_H$	$p_H - C_H$
24	H	I	$\tilde{O}$	p_H	nb	0	$-C_H$
25	H	O	$\tilde{I}$	p_L	b	$u(E(q)) - p_L - c$	$p_L - C_H$
26	H	O	$\tilde{I}$	p_L	nb	$-c$	$-C_H$
27	H	O	$\tilde{I}$	p_H	b	$u(E(q) - p_H - c$	$p_H - C_H$
28	H	O	$\tilde{I}$	p_H	nb	$-c$	$-C_H$
29	H	O	$\tilde{O}$	p_L	b	$u(E(q)) - p_L$	$p_L - C_H$
30	H	O	$\tilde{O}$	p_L	nb	0	$-C_H$
31	H	O	$\tilde{O}$	p_H	b	$u(E(q)) - p_H$	$p_H - C_H$
32	H	O	$\tilde{O}$	p_H	nb	0	$-C_H$

Table 1: Table of the payoffs of each end node of the game

$\tilde{t} = \tilde{I}$, he will use the conditional probabilities φ and $1 - \varphi$ to consider the expected value of each of the two price strategies, as well as the probability of having the condition $u(E(q)) < p_H$ to be met, knowing that the distribution of $u(E(q))$ is uniformly distributed over the interval $(0, \tilde{u})$. In particular, choosing

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p_H over p_L is profitable if:

$$p_L \leq p_H \left[\left(1 - \frac{p_H}{\tilde{u}}\right) - \varphi \left(1 + k - \frac{p_H}{\tilde{u}}\right) \right] \tag{1}$$

Similarly, when he observes $\tilde{t} = \tilde{O}$ and knows that $q = L$, the choice of the seller will be made considering the distribution of $u(E(q))$ and the conditional probabilities θ and $1 - \theta$. The condition for preferring p_H to p_L is:

$$p_L \leq p_H \left[\left(1 - \frac{p_H}{\tilde{u}}\right) - \theta \left(1 + k - \frac{p_H}{\tilde{u}}\right) \right] \tag{2}$$

Notice that (1) and (2) right-hand sides are decreasing in φ and θ, respectively: this means that the higher the probability of actually trading with an insider when $q = L$, the higher the risk of incurring the cost linked to the reimbursement in case $p = p_H$, so the narrower the space of parameters for which p_H is preferred to p_L.

When $q = H$, the strategy $p = p_L$ is always dominated by p_H, given the assumption we made on the relationship between the two prices.

Studying step 3 buyer's choice, we have to take into account both the conditions in (1) and (2). When both conditions hold, the expected value for choosing $\tilde{t} = \tilde{I}$ for the insider would be equal to the one of choosing $\tilde{t} = \tilde{O}$, namely $\phi(u(H) - p_H)$.[11] Conversely, for the outsider choosing $\tilde{t} = \tilde{O}$ would yield an expected payoff equal to 0, while choosing $\tilde{t} = \tilde{I}$ would lead to $-c$, so the outsider will prefer to declare his actual type.

When neither (1) nor (2) hold, the insider would still be indifferent between the two strategies, having the same payoff $\phi(u(H) - p_H) + (1 - \phi)(u(L) - p_L)$, while the outsider would prefer to declare his actual type since the expected payoff would be $(1 - \phi)(u(E(q)) - p_L)$, while the one in case $\tilde{t} = \tilde{I}$ would be $(1 - \phi)(u(E(q)) - p_L) - c$.

When condition (1) does not hold while condition (2) holds, the insider will

[11] Hereafter, we assume that when a buyer is indifferent between disclosing his actual type and misdisclosing it, he will declare his actual type.

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strictly prefer to declare his actual type since in that case the expected payoff would be $\phi(u(H) - p_H) + (1 - \phi)(u(L) - p_L)$, while he would only get $\phi(u(H) - p_H)$ if he chooses $\tilde{t} = \tilde{O}$. The case of the outsider is different since he would get $(1 - \phi)(u(E(q)) - p_L) - c$ in case he chooses $\tilde{t} = \tilde{I}$, and he would get 0 in case he would declare himself an outsider. Choosing $\tilde{I}$ is preferred to choosing $\tilde{O}$ when:

$$c < (1 - \phi)(u(E(q)) - p_L) \tag{3}$$

suggesting that the cost for mimicking the insider when trading with the seller has a role, and signalling himself as an insider can be fruitful if the probability of having a low-quality piece is high enough (or if the gap between the expected utility and the low price is high enough) with respect to the cost c.[12]

3. Discussion: Is (seller) ignorance bliss?

The model illustrated in the previous section shows that several type of equilibria can be identified, given a series of conditions. In particular, when both conditions (1) and (2) hold (do not hold) together, we have that each collector will disclose information about his actual type (namely, I will choose $\tilde{t} = \tilde{I}$ and O will choose $\tilde{t} = \tilde{O}$). This is also found in case the condition (2) holds but (1) does not, and (3) does not hold either. Conversely, when the condition (1) does not hold while conditions (2) and (3) do hold, both the insider and the outsider would present themselves as insiders. But is this source of uncertainty on the seller's side a way to improve the outcomes of asymmetric information on the buyer's side?

If we look at the payoffs of each agent under each possible combination of conditions among those that we took into account, we will have that the outsider will never actually get a high-quality piece, but what can happen is instead that the uncertainty on t and $u(E(q))$ makes the seller prefer to fix the right

[12] We did not consider the case when (1) holds and (2) does not because this would require that $\theta > \varphi$.

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price for low-quality pieces, i.e., $p = p_L$, even when the buyer declares himself as an outsider. When (1) and (2) do not hold, the seller will choose $p = p_H$ whenever $q = H$ and $p = p_L$ whenever $q = L$, and the insider would choose to trade both the qualities ($tr = b$), while the outsider would buy the artwork only when $p = p_L$. In other words, the high quality will remain in the insider's hands, while the low quality can be bought by both types of buyers. Notice that this case is a case of "perfect disclosure", i.e., a separating equilibrium: the outsider collector will choose $\tilde{t} = \tilde{O}$ and the insider will choose $\tilde{t} = \tilde{I}$, but this is not a sufficient condition to have the seller behave honestly.

In fact, when (2) holds and (1) and (3) do not, the collectors would both declare their actual type, but the seller would fix $p = p_H$ every time a buyer declares himself as an outsider (incurring the trade condition $tr = nb$, since only the outsider chooses $\tilde{t} = \tilde{O}$). In this case, then, only the insider will buy the artwork, paying p_H if $q = H$ and p_L if $q = L$. Both qualities potentially remain in the market, but outsiders are excluded from the trades.

Another case of perfect disclosure where the seller does not behave honestly is when both (1) and (2) hold: in this case, the seller will choose $p = p_H$ independently on q, leading to $tr = nb$ if the buyer is an outsider and to $tr = b$ if he is an insider. Notice that, however, when $q = L$, the insider would check the quality of the artwork after purchase and ask for the reimbursement afterwards, so this combination of parameters defines a market where only high quality is traded and it is bought only by insider collectors. Low quality is out of the market and outsiders as well.

A final case to consider is the "pooling disclosure" (a pooling equilibrium), namely, when both buyers would choose $\tilde{I}$ as $\tilde{t}$, which is observed if (1) does not hold, but (2) and (3) do hold. In this case, the seller cannot discriminate between insider and outsider, and he will also have incentive to well-behave, fixing $p = p_H$ when $q = H$ and $p = p_L$ when $q = L$. As in the case when both conditions (1) and (2) do not hold, the insider would buy the good, paying for its right price, namely $p = p_H$ for $q = H$ and $p = p_L$ for $q = L$, while the outsider will only buy low-quality goods at p_L.

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The introduction of uncertainty in the buyer's type does not seem to benefit the outsider collectors, since the results we found are, at best, the same that are likely to be found in a market without uncertainty on t for the seller, since the outsider would not buy high quality and it will only be willing to trade low quality. In our model, in some cases the outsiders are even ousted of the market. What should be noticed in these results is instead the case of a unique pricing strategy ($p = p_H$ independently on q), which makes the low quality exit the market (and the outsider collectors as well). This "counter-lemon" result, namely the opposite of a lemon issue, is only found when p_L is low enough with respect to p_H so that both (1) and (2) are met. Hence, the seller uncertainty does not directly benefit the outsider collectors, but it can have an impact on the quality traded in the market. However, this uncertainty could possibly create an elitist market, where non-expert agents cannot enter.

If we think about low quality as fake or forged artworks, the implications of this "ignorance" can possibly be fruitful for the whole art market, hindering the circulation of these pieces, even though excluding part of the collectors from the market. Analysing the effects on welfare of the seller uncertainty we are considering, which is still a market inefficiency, needs to define what is the welfare we want to maximize: if those of the buyers, those of all the agents in our model, or other measures that also consider the future circulation of the artworks in the market. This, however, is beyond the aims of this paper.

4. Conclusions

In this paper, we model two types of private art market asymmetric information, namely the buyer's imperfect information about artwork quality and the seller's uncertainty about which type of collector he is trading with. In our setting, the seller knows the good quality before trading, but he does not know if the buyer is informed or not; the buyer does not know the quality of the artwork, and only if he is an insider can identify it after purchase, and he can signal his type to the seller, possibly misdisclosing it to take advantage of the

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seller uncertainty, incurring a cost if he is an outsider. The strategic interactions between the seller and the collectors allow us to identify the conditions for observing different equilibria about the disclosure of the type of the buyer, with different results concerning quality traded in the market and pricing strategies. Our results show that the seller uncertainty does not seem to advantage the outsider collector in any of the equilibria, with respect to the case of lack of uncertainty. However, in one of the equilibria we find a "counter-lemon" mechanism for which low quality and the outsider collectors exit the market, so the seller "ignorance" can indeed be fruitful for the art market if low quality pieces are fakes or misattributed artworks, all at the expenses of less informed collectors who are excluded from the market. However, the "counter-lemon" market becomes an elitist and highbrow market, where only insiders can purchase of artworks.

Our contribution could be extended by taking into account a dynamic setting in which a buyer could learn by consuming and a seller could choose to behave non-opportunistically in order to obtain (or maintain) a good reputation. Distinguishing between high-quality, low-quality, and fake artworks can also help shedding light on the actual impact on the pieces traded in the market of the different types of asymmetric information we considered. Additionally, a full market structure, with more art market stakeholders, such as the artists and the experts, could be assumed in order to study which sales are more likely to be observed. Finally, since the effect of the seller uncertainty is a market inefficiency, we could define the buyers' and the social welfare to compare the efficiency of the lemon and "counter-lemon" market outcomes, and consider possible public interventions in line with the reimbursement policy for unaware purchases of fake artworks, as they are emerging in several countries. One could also compare the impact of the reimbursement on welfare with the importance of having a market that is safely accessible also to non-experts.

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