IMT School for Advanced Studies, Lucca

Lucca, Italy

Essays on Economics of the Arts

PhD Program in Economics

XXIX Cycle

By

Francesco Angelini

2017

The dissertation of Francesco Angelini is approved.

Program Coordinator and Supervisor: Prof. Massimo Riccaboni, IMT School for Advanced Studies Lucca

Co-Advisor: Prof. Andrea Vindigni, University of Genova

Co-Advisor: Prof. Davide Ticchi, Marche Polytechnic University

The dissertation of Francesco Angelini has been reviewed by:

Prof. Guido Candela, University of Bologna

Prof. Lorenzo Zirulia, University of Bologna

IMT School for Advanced Studies, Lucca

2017

To Beatrice, Ezio, and Paola

"Art shouldn't be fanatical."
Willem de Kooning

Contents

List of Figures

List of Tables

Acknowledgements

First and foremost, I would like to sincerely thank my advisor Prof. Massimo Riccaboni and my co-advisors Prof. Andrea Vindigni and Prof. Davide Ticchi for their support during my Ph.D. and for the possibility they gave me to meet some of the most important economists alive during my period at IMT, as Oded Stark, Gilles Saint-Paul, Gérard Roland, James A. Robinson, Laurence J. Kotlikoff, Kiminori Matsuyama, and to attend their lessons. I also want to express my gratitude to them for the interesting discussions we had on topic related to my research, and for sharing their points of view and knowledge.

Besides my advisors, I also want to thank Prof. Massimiliano Castellani at University of Bologna, co-author of Chapters 2, 3, and 4, for his support and for the pleasure I had in working with him.

I would like to thank Prof. Guido Candela and Prof. Lorenzo Zirulia, for their helpful comments and suggestions on the first version of my thesis.

I want to express my sincere gratitude to Professor Gilles Saint-Paul, to Dr. Matteo Squadrani, and

to Prof. Pier Paolo Pattitoni, for their insightful comments on previous versions of the papers this dissertation consists of, as well as the participants of the Workshop on Economics topics organized by Prof. Vindigni on December 6, 2016 at IMT School for Advanced Studies Lucca for their suggestions.

I thank my fellow colleagues from ECON in Lucca for the time of work and the time of fun we shared, in particular Davide Donofrio, Duccio Gamannossi, and Benedetta Frassi, and also the colleagues from other tracks: Alessandro Beggiato, Giada Cerri, Michela Del Vicario, Samuele Dominioni, Silvia Giordano, Chiara Iorino, Pietro Lenarda, Rita Morisi, Lorenzo Stella, Fabiana Zollo.

I also want to thank all the professors at University of Bologna who hosted me in Bologna, in Rimini, and in Ravenna, during the writing of my thesis.

Finally, I want to thank my family, who has been present in every moment.

Vita

February 20, 1989	Born, Urbino (PU), Italy
2011	Bachelor in Economics (Laurea Triennale) Final mark: 110/110 cum laude University of Bologna, Rimini (RN), Italy
2013	MA in Economics (Laurea Magistrale) Final mark: 110/110 cum laude University of Bologna, Bologna (BO), Italy
2015-16	Visiting Student (October-September) University of Bologna Bologna (BO), Rimini (RN), and Ravenna (RA), Italy

Publications

1. F. Angelini, "Le aste online: le vendite in Italia di arte visiva su eBay," in *Sistema Economico*, vol. 2010(1), pp. 5-20, 2012.
2. F. Angelini, "Italia, Germania, Giappone. Mercati del lavoro a confronto dal dopoguerra a oggi," in *Globalizzazione e Localizzazione dei Mercati del Lavoro* (ed. Massimiliano Castellani), University of Bologna/CGIL/Cesvip Report, pp. 2 – 31, 2013.

Presentations

1. F. Angelini, "Trade as a flow of ideas," at *University of Bologna*, Rimini, Italy, 2015.
2. F. Angelini, "Understanding the artwork pricing: A multiple bilateral bargaining game (written with Massimiliano Castellani)" during the Workshop on economics topics at *IMT School for Advanced Studies Lucca*, Italy, organized by Prof. Andrea Vindigni, 2016.
3. F. Angelini, "Value and information in the art market: A behavioural pricing model (written with Massimiliano Castellani)" during the Workshop on economics topics at *IMT School for Advanced Studies Lucca*, Italy, organized by Prof. Andrea Vindigni, 2016.

Abstract

In the recent years, a vast number of economic studies focused on the art market and on its development, as well as on the artists as agents of a labour market with features that are particular of art market. However, really few studies analyzed the functioning of the art market as a whole with a theoretical approach, often considering the artist as nothing more than a simple producer of artworks. This dissertation aims to enrich the economics literature with the above-mentioned missing parts.
In Chapter 2 we build a model for studying the price formation in the private art market in a context of complete information and full rationality, using a game theory approach. In this first part, the key variables in this market are the market powers of the agents in the market, that define what is the channel through which a certain artwork reaches the public market. Chapter 3 firstly better defines what are the economic and cultural values and how their formation works for artworks, and then it introduces in the just-created framework the effects of information asymmetry among the agents operating in the market, and behavioural aspects in the choices of some of them: besides market powers, also information has a key role in the art market,

and it mainly depends on artists' characteristics, as fame and talent. Chapter 4 empirically investigates these artists' characteristics, creating a new measure for them, through the use of hedonic regression and quantile hedonic regression, finding that this measure presents a bimodal distribution in all the specifications we implemented, coherently with the superstar theory in the art market, and that there exist various effects than influence the ranking created using our measure.

Chapter 2

Chapter 2 analyses the pricing of artworks just created by an artist and sold for the first time in the art market, investigating the price-formation mechanism at work in the private art market. In particular, a game theory approach is used to consider the possible channels (paths) that a new artwork can take to reach a collector or an auction house, assuming price-maximizing agents with full information on market powers and reserve prices. The study is aimed to identify the relationships between the artwork prices and the market power of agents operating in each channel of the market. What we find is that the market power of each of the agents is key to identify the market channel that will be preferred by the artist and, then, her incentive in creating a new artwork. At the same time, the importance of art market intermediaries as the galleries in the for-

mation of art prices is attested and their incentives to enter and remain in the market are confirmed.

Chapter 3

Chapter 3 aims to explore the role of cultural and economic value, and of the information on private art market price formation; in this Chapter, we develop a bargaining game model in which we explicitly consider the effects of these issues. Furthermore, we introduce artists' fame and talent as determinants of an artwork's cultural and economic value. Assuming artists, galleries, and collectors have different levels of information on the quality of the artworks and on the characteristics of the artists, we study the behaviour of these agents and the potential emergence of disappointment for the sophisticated collectors and undertreatment for the unsophisticated ones. Artworks will be treated as credence goods, experience goods, or search goods, depending on the level of information each agent has at his disposal; this influences the way the price is formed and how the surplus of the trade is shared among the agents in certain particular trade channels.

Chapter 4

In Chapter 4, we aim to empirically analyze those characteristics of the artists that influence cultural

and economic values, in order to understand how the art market considers them in the formation of prices. To do so, using a unique hand-collected dataset from the Artist Re-sale Rights (ARR) archives of the Società Italiana degli Autori ed Editori (SIAE), we build a novel index of artists' talent and fame in the Italian art market. The distribution of this measure and the ranking of the artists' index is analyzed in several model specifications, and the dynamics of the index is also qualitatively studied. Despite of the existence of a price effect, a time effect, and an art genre effect, coherently with the superstars theory, the bimodality of the distribution is confirmed in all our empirical findings.

Chapter 1

Introduction

The year 2014 has been a record year for art market, with 68,237 millions of dollars and over 38.8 millions of transactions, as reported by the 2016 TEFAF Art Market Report; 2015 presents slightly smaller numbers, with, however, over 63 billions of dollars of total exchanged value.[1] Even if some of the biggest art markets in the world, as the Chinese one, saw a decline since 2014, other countries' markets keep on growing, as, for example, the United States', that reaches the record level of 27.3 billions of dollars in exchanges in 2015. If one compares the record results for the worldwide art market exchanges in 2014 with GDP of countries, we have that the art market transactions value accounts for more than the Dominican Republic and other 125 countries of the World GDP in 2015 (World Bank, 2016).

If we look at the top prices reached for a single artwork, we have that some of these were sold at more than 200 millions of

[1] See Kinsella (2016*b*) for an analysis.

Table 1: Top 10 Lots by Living Artists, 2012-16 (from Kinsella (2016*a*))

Rank	Artist	Sale date	Auction house	Price (USD)
1	Jeff Koons	November 2013	Christie's NY	58,405,000
2	Gerhard Richter	February 2015	Sotheby's London	46,352,959
3	Cui Ruzhuo	April 2016	Poly Auction (Hong Kong)	39,564,634
4	Gerhard Richter	May 2013	Sotheby's NY	37,125,000
5	Jasper Johns	November 2014	Sotheby's NY	36,005,000
6	Gerhard Richter	October 2012	Sotheby's London	34,273,027
7	Jeff Koons	May 2014	Christie's NY	33,765,000
8	Jeff Koons	November 2012	Christie's NY	33,682,500
9	Gerhard Richter	February 2014	Christie's London	32,563,228
10	Gerhard Richter	November 2014	Christie's NY	31,525,000

dollars, as Willem de Koonings "Interchange" and "Nafea Faa Ipoipo" by Paul Gauguin, both sold in 2015 for around 300 millions, and "Number 17A" by Jackson Pollock, sold for around 200 millions of dollars, through private selling; for what concerns selling at auction, in the same year both Pablo Picasso's "Les Femmes dAlger" and Amedeo Modigliani's "Nu Couch by Amedeo Modigliani sold for more than 170 millions. Kinsella (2016*a*) presents the top selling lots of living artists for the period from 2012 to October 2016, sold through auction; Table 1 reports the 10 top selling lots, all of them sold for more than 30 millions of dollars.

This growth of the importance of the art market has drawn the attention of economists, in particular of scholars from cultural economics, the branch of economics that focuses on the study of cultural goods and culture in general: while a Cultural Economics Association exists since 1973 and a *Journal of Cultural Economics* has been issued for the first time in 1977, this topic received an increasing attention in the last 20 years, as demonstrated by the contributions that come from both economics and management, as the books by Klamer (1996), Caves (2000),

Throsby (2001), Candela and Scorcu (2004), Hutter and Throsby (2008), Snowball (2008), and Zorloni (2013), and sociology, as the works by Olav Velthuis and coauthors (Velthuis, 2007; Lind and Velthuis, 2012; Velthuis and Baia Curioni, 2015). Cultural goods, nowadays, are not only interest of collectors, that keep on buying artworks merely for the pleasure they obtain from their value, and economists, but also financial markets began to pay attention to the art market, seeing artworks, mainly from fine arts, as an investment good (Anderson, 1974; Campbell, 2008, 2009; Mandel, 2009). In the recent years, in fact, art funds became more and more important in the market, buying fine art pieces, with returns up to 14.9%.[2] Clearly a collector can understand the investment value of an artwork, while he benefits from its aesthetic.[3] One of the main issue in this market, then, consists in understanding how the price of the artworks is formed. Artworks are usually unique and hence an analysis of the supply and the demand using standard economics methods is not possible, that is, there is not an "equilibrium price"; however, one can study how the price of an artworks is formed depending on the agents of the market that trade it, which usually results from a bargaining between the parts. In Chapter 2, we build a complete-information and full-rationality model based on Nash-bargaining, that describes how the private art market works and studies the price-formation mechanism operating in it, in order to understand how the bargaining price is formed and what are its determinants, as well as what are

[2]See Hodges (2015) and Schwartz (2015). For a discussion about the financialization of art, see Velthuis and Coslor (2012).

[3]Baumol (1986), Baumol and Throsby (2012), and Candela et al. (2013) explain the concept of psychic dividend (or aesthetic dividend) and how it influences the collectors' choices when they buy artworks.

the rationale behind the existence of different trade channels. We present necessary and sufficient conditions to observe each possible market path among those that characterize the private art market, and demonstrate that every agent makes a choice which is based on his market power and on the market power of the individuals that follow him in the potential paths that start from his node.

In our analysis as presented in Chapter 2 we did not consider any of the potential market failures that characterize the art market.[4] An important market failure in the art market is the one related to asymmetric information, which is a particularly important issue given the difficulty in collecting information on the value of the artworks and on the artists, together with the low level of regulation that characterizes the art market.[5] The attention the literature paid to the asymmetric information issue, however, is limited and it consists mainly on qualitative studies; in fact, only few scholars analyzed this issue with a theoretical and analytical approach. To fill this gap, in Chapter 3 we modify the model proposed in Chapter 2, introducing the asymmetric information issue and other aspects of the behaviour of the agents in the art market related to the difficulty they can find in evaluating an artwork. In fact, artworks are particular products since they contains two distinct but linked values, that is, the cultural value and the economic value; the

[4]For example, some particular kind of art productions are public goods, as musical compositions (see Santagata (1995)) and, in some cases, are subsidized, as discussed for example in Champarnaud et al. (2008). See also Snowball (2008).

[5]Indeed, some regulation mechanisms exist in this market, as the *droit de suite* or Artist Re-sale Rights, the quote of the selling price when an artwork is resold that goes to the artist if certain conditions are respected; see Candela et al. (forthcoming) and Chapter 4.

former influences the latter, and the evaluation of each of the two, which has an effect on the price, is characterized by particular features, that depends on the available information and on the ability a certain agent has in interpret the components and the determinants of the artwork's values. Despite the asymmetric information issue, we demonstrate that high-quality artworks are not washed out from the art market, thanks to the presence of uncertainty on the values of the artworks. The multiple-value issue of the art products has been studied by several scholars in both cultural economics and other fields, as philosophy, sociology, art history, but economics literature lacks of an overview that would make the various points of view coherent: in Chapter 3 we also propose a benchmark for this topic, the one introduced by Throsby (2001), and we lead the contributions on this topic by other scholars back to this benchmark, when possible.

Artworks can be considered products of the artist, but the artist is more than a simple producer; cultural economics literature considered this agent mainly as an active individual in the labour market[6] and for what concerns her income[7] while less has been said on the artist's characteristics that affect the value of her artworks and how these characteristics influence the creation of the artworks themselves. Chapter 3 presents an overview of the two main artists' characteristics, that is, talent and fame, and link them to the production of cultural and economic values of the artworks. In Chapter 4, we present a novel mea-

[6]See for example Towse (1996), Caves (2000), Caserta and Cuccia (2001), Blaug (2001), Cuccia and Cellini (2009), Menger (2006), and Towse (2006).

[7]The superstar theory contributions, beginning with Rosen (1981) and Adler (1985), focus on the relationship between reputation and income; Chapter 4 reports the principal works of this branch of literature.

sure for these characteristics, based on a unique hand-collected dataset from SIAE (Società Italiana degli Artisti ed Editori), using hedonic regression and quantile hedonic regression methods, and we study how this new measure behaves for what concerns the ranking obtained using it in various specifications, as well as how it distributes. We identify different effects on the ranking, as the price effect and the time effect, and we find strong evidence of a bimodality in the distribution of the index, which is not affected by changes in the specification of the model, and which is coherent with the superstar theory in cultural economics.

Chapter 2

Understanding the artwork pricing: a multiple bilateral bargaining game

2.1 Introduction

"Haggling for art" is a renowned habit in the art market, though the size of the discount that sellers apply to the price of artworks is not widely recognized.[1] For example, gallery owners are willing to negotiate but the discount size is not fully advertised depending on the specific conditions of the sale, and each gallery can handle it differently. Recently, the Wall Street Journal published an article in which Daniel Grant wrote:

[1] Velthuis (2007) reports various discount policies that galleries apply, as for example the courtesy discount, the museum discount, the flexibility discount, and so on.

> When it comes to fine art sold in galleries, there's the asking price. And then there's the price most people pay... "Galleries never have sales, it's considered bad taste", says Manhattan contemporary art gallery owner Renato Danese. Still most art sold by him, and other dealers, he says, goes for something less than the stated price. There is a certain etiquette to the conversation. "A client comes in and says, 'I'm interested in this painting', Mr. Denato says, and I say, 'I'm glad that you respond to it positively'. The client asks, 'What is the price?' I tell him the price. He says, 'Can you help me out with that?' and I may offer 10 percent". Debra Force, a New York City-based dealer in American art, agrees. "Every work is discounted", she says. "I can't think of an instance in a long time where someone paid the asking price".[2]

As a matter of fact, the posted prices is a well-known method of prices formation mechanism, and the haggling for art is still the most used mechanism in the art market where the "spirit of the bazaar economy" is dominant (Arnold and Lippman, 1998; Velthuis, 2011).

The mechanism on how the price is formed is widely studied in the economic literature within the general framework of the problem of the optimality of the various selling methods. The literature presents mixed results regarding the efficiency of the selling methods (auction, bargaining, and posted price), both from the seller's and from the buyer's perspective, and consid-

[2]See Grant (2013).

ering different level of costs.[3]

How does the art market work for what concerns the price-formation mechanisms? To answer this question, we need to know what is the selling method actually used by the sellers of artworks and we have to study both the behavior of the agents (artists, dealers, collectors) involved in the artwork trades and their role (as sellers or buyers) in each transaction, that is, what are their relationships with the other agents. In the art market the selling methods widely used are the bargaining, the posted-price selling, and the auctions. The posted-price mechanism is the galleries' preferred selling method, auction is the best-known and most studied mechanism in the economic lit-

[3]Without auctioning costs, auctioning is always optimal compared to posted-price selling, while, when bargaining costs no more than posted-price selling, the bargaining is always optimal compared to posted-price selling (Wang, 1993, 1995). Bulow and Klemperer (1996) show, under reasonable assumptions, that the auction is always preferable to negotiations, but, according to Bulow and Klemperer (2009), when participation is costly the sequential process is always more efficient than a simple simultaneous auction. Lu and McAfee (1996) identifies a new advantage of auctions over bargaining, since auctions are evolutionarily stable equilibria, whereas in a similar setting, Kultti (1999) shows that auctions and posted prices are practically equivalent. Arnold and Lippman (1998) compare bargaining and posted-price mechanisms in a market with discounting, positive transaction costs, private buyer's reserve price and buyer's bargaining ability, stating that a critical value of bargaining ability exists, so that they can establish when the use of bargaining or of a posted price results to be optimal. Cason et al. (2003) compare posted-price and bilateral bargaining market institutions finding that efficiency is lower, sellers price is higher, and prices are stickier under haggle than under posted price. Campbell and Levin (2006) demonstrate that the posted-price rule may outperform the best possible standard auction mechanism when values are interdependent. More recently, Hammond (2010) and Chow et al. (2015), using data for compact discs and real estate sales, respectively, find empirical evidence on the performance of the main selling methods: Hammond (2010) finds that posted-price goods sell for higher prices, while auctioned goods sell with a higher probability; Chow et al. (2015) find that auctioned properties obtain a price premium or suffer a price discount compared to negotiated sales properties, depending on property type and market conditions end properties.

erature, but the bargaining is the actual mechanism at work for art: when galleries post a price or auction houses fix an auction fee, usually, a bargaining process on discounts of posted prices or auction fees occurs between the seller/buyer and the dealer (Ashenfelter, 1989).[4]

Despite the anecdotal evidence, our research question is still unanswered, since economic theory lacks of a model that fully depicts the role of the selling methods in the art market and provides empirically testable implications of artwork prices. To fill this gap, in this paper we model the functioning of the art market for what concerns the artworks just created and sold for the first time by the artist. In particular, following a game theory approach, we consider the possible channels a new artwork can take to reach, directly or indirectly, an auction house or a collector who will not resell the artwork, and we focus on the relationships between artwork prices and market powers of agents working in a each channel of the market, assuming that agents are price-maximizers with full information on market powers and reserve prices.[5] Thus, every time an artwork is auctioned, the artwork is out of the particular framework studied in this paper.

The remainder of the paper is organized as follows. In Sec-

[4] According to the the TEFAF Art Market Report 2014 edited by Clare McAndrew, in 2013 48 percent of trades was intermediated by auction houses and 52 percent by galleries. In the domestic markets of developed countries (USA, France and UK) the galleries market share was 55 percent. In Italy, according to the NOMISMA Art Market Report 2013, galleries had a market share of 73 percent, while in the Dutch market the galleries' market share is of 56 percent (Velthuis, 2007).

[5] The hypothesis of full information implies that the art goods can be seen as search goods. For an analysis of information asymmetry in the art market where the art good can be either a search, an experience, or a credence good, see Chapter 3.

tion 2.2, we briefly review the relevant literature and emphasize our contribution. In Section 2.3, we introduce the theoretical framework, we solve the model, and we study the effect of the agents' bargaining power on bargaining prices. Section 2.4 concludes the paper.

2.2 Contribution to the literature

The interest economists put on the art market has been increasing in the last years (see for example the books by Caves (2000), by Throsby (2001), by Candela and Scorcu (2004), and by Zorloni (2013)), with a main focus on the price-formation mechanism of artworks in the "secondary market" and on the auctioning in particular (Ashenfelter and Graddy, 2003).
In the literature there are several art market's segments definitions. A good definition of primary and secondary market is given by Throsby (1994, p.5): the former is where "unorganized individual artists provide works to galleries, local art fairs and exhibitions, small dealers, and private buyers", while the latter consists in "established artists, dealers, and public and private collectors" who "circulate work by live artists who have managed to make the transition from the primary market". An alternative definition of primary market is given by Velthuis (2003, pp.181-182), describing it as "the market where contemporary artworks are sold for the first time". Also Schönfeld and Reinstaller (2007, p.144) give a similar definition, saying that "[t]he primary market comprises all artworks without provenance, i.e., the market where artworks are sold for the first time. Art reentering the market is sold in the secondary market segment". Zorloni (2013, p.58) contains an alternative description

of the primary and secondary markets, identifying the former as the market "where private collectors or dealers buy works of art directly from the artist or other private individuals" and the latter as the one where "the exchange takes place between the individual via the intermediary of the auction house". Finally, Candela and Scorcu (2004) define the primary market as the artist's market, the secondary market as the gallery's market, and they also introduce the "tertiary market", defining it as the auction's market. In what follows, we adopt the Velthuis's and Schönfeld and Reinstaller's definitions, together with the definition in Candela and Scorcu (2004) for the tertiary market. As we hinted above, little attention has been paid to the theoretical functioning of the "primary market" and the galleries' role,[6] though there is a series of papers that study this issue under an empirical point of view (both quantitative, as Rengers and Velthuis (2002), Beckert and Rössel (2004), Hutter et al. (2007), and the analysis in Chapter 4, and qualitative, as Velthuis (2002, 2003, 2007, 2011)), or using a simply descriptive approach, as Peterson (1997), Kawashima (1999), Benhamou et al. (2002), and Caves (2003). In particular, Velthuis (2003) focused on the price-formation mechanism of art galleries identifying the existence of "pricing scripts" used by the dealers, that generally consist in a series of rules for which the price is never decreased but, at most, discounted (Schönfeld and Reinstaller (2007) develop a model of competition among galleries which is consistent with these pricing scripts); under a more marketing-oriented point of view, Cellini and Cuccia (2014) analyse the price-formation mechanism in the primary market, considering the artist and the art dealer as part of the same marketing

[6] See Shubik (2003) and Schönfeld and Reinstaller (2007).

channel.
Beside the distinction between primary and secondary markets, Velthuis (2002) introduces the distinction between public and private market, based on the availability of the information about the price of an artwork:

> [...] auctions prices differ from gallery prices because of their public character. Major auctions are covered by newspapers and magazines while their prices are publicly available. [...] By contrast, gallery sales have an exclusive, private character; details of a transaction, including the price, are difficult to find out for outsiders.[7]

Starting from these classifications of the art market, one can see that there exist several overlapping cases between them: for example, an artwork in the secondary market could still have a private price if it was sold by the artist directly either to a gallery or to a collector; at the same time, an artwork sold by the artist which reached the market with the intermediation of an auction house has a public character also if it lays in the primary market. However, the mechanism of how the private price is formed in the primary market lacks of a theoretical foundation as well as the role of gallery in this market has been insufficiently investigated by economists; as pointed out by Benhamou et al. (2002, p.264):

> The economics of art galleries has widely been neglected by researchers because of the lack of information. In such an economic context, it is more

[7] Velthuis (2002, p.138). Notice that, as we pointed out above, Zorloni (2013) defines as primary market what Velthuis (2002) calls private market, while she defines as secondary market what he calls public market.

important than ever to open the black box of the "white cube".

Our paper contributes to the literature shedding light on the private price-formation mechanism in the primary market, a sort of shadow market where the new artworks that have never been auctioned before are traded, and where the role of galleries is key. However, our analysis covers also how private price is formed in secondary and tertiary markets. Before proceeding to depict the functioning of the part of the market that stays at the foundations of the whole art market, we have to open the black box and explore the bargaining process used as selling method that stays behind the private price-formation mechanism.

2.3 The model

In our model of the art market there exist two types of trade mechanisms (auction (A) and bargaining (B)) and four types of agents (the auction house (h), the artist (a, "she"), the gallery (g), and the collectors).[8] The market structure of the auction is a monopoly where several bidders (b) make bids, a single seller (s) takes bids and sells the artwork to the highest bidder. The structure of the bargaining is a bilateral monopoly where the artwork trade takes place after the bargaining between a single seller and a single buyer.[9] In this framework, the auction

[8] Another pricing mechanism that actually exists in the art market is the posted price method; however, bargained discounts of posted prices are commonplace in art market, as we pointed out in Section 2.1.

[9] As stated by Baumol (1986), the owner of an artwork, being it unique, may be considered as a monopolist in the market of that specific artwork; in fact, even if they are similar and made by the same artist, are imperfect substi-

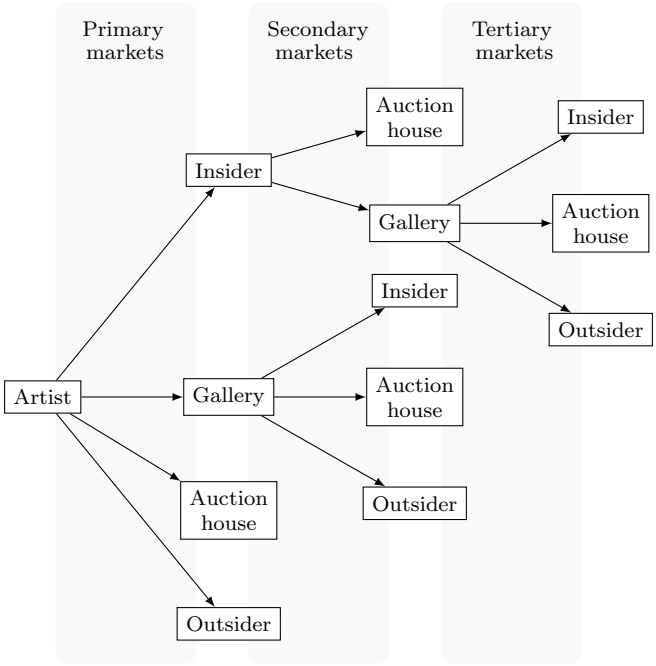


Figure 2.1: Full set of potential bargaining

house intermediates trades between the seller and the bidders; the artist makes artworks which can be sold in the art market through auctions or via bargaining with the gallery and/or collectors, so that the artist can only be a seller. The gallery can sell the artworks bargaining the price with the collectors or with the

tutes. Zorloni (2013) also points out that the relationship between an artist and a dealer can be seen as a bilateral monopoly.

auction house, and then it can be either a seller or a buyer.[10] Finally, there exist two types of collectors: the insider collector (i, "he"), who can be either a seller or a buyer, and the outsider collector (o), who can only buy the artwork and cannot resell it; the former is a sophisticated collector, who knows how the art market works and who are its agents, while the latter is a more naive collector, with less knowledge of the market. As in Baumol (1986), in fact, in the art market there exist 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).[11]

[10]Cellini and Cuccia (2014) highlight the existence of artist who act as "a manager of himself or herself", becoming in some cases also dealer of her own works, also if this situation is not frequent. In our model, as we will see, this situation concerns the case in which the artist sell her artwork to the sophisticated collector. For what concerns the auction house presence in the primary market, Velthuis (2011) points out that this situation is not standard in the Western markets, and it happened only on 2008 with Damien Hirst's one-man auction held by Sotheby's (see also The Economist (2008)), and on charity auctions, while it is a normal habit in emerging markets as China and India; in the past, impressionists and post-impressionists used to sell their works directly through auction houses. Obviously, only most famous artists that are already recognized by the market as being successful can directly sell their artworks by auctions. Moreover, as noted by Graw (2012) reporting Warhol's words, galleries sell also to auction houses "in order to bid up prices in advance of their own sales" (p.194).

[11]The terms "insider" and "outsider" were first introduced by Bonus and Ronte (1997). Zorloni (2013) too describes the segmentation of the art market identifying two types of buyer: one (the insider) who is "focused on one or very few sectors of the market and" is "driven purely by the desire to collect art for its own sake, with a high level of knowledge and connoisseurship", and a second group (the outsiders) that includes "collectors, often younger with considerable wealth and disposable income" that "often had less knowledge and experience of art market". McCain (2006) presents a model of cultivation of taste which is able to generate a bimodal distribution of buyers, in which each of the two peaks of the distribution can be seen as the average level of taste of the outsiders (the smaller peak) or the insiders (the bigger peak); a key variable in McCain's model is the "arts capital" an individual is endowed with, which could be linked to exposure to arts in childhood, as pointed out by

Combining all possible outcomes, we have twelve potential bargaining: one bargaining between the artist and the insider, one between the artist and the gallery, one between the artist and the auction house, and one between the artist and the outsider; one bargaining between the insider and the auction house, one bargaining between the insider and the gallery, two bargaining between the gallery and the auction house, two bargaining between the gallery and the insider, and two bargaining between the gallery and the outsider (see Figure 2.1).
Among these possible negotiations, we can omit the interaction between the outsider and the artist (ao path), since the former is not able to reach the latter, the one between the insider and the gallery in the agi path, since the former can avoid to buy from the latter if he wants a certain artist's artwork, and the one between the insider and the gallery in the $aigi$ path, since the former would repurchase the artwork he sold to the gallery. We are then left with nine potential bargaining: one bargaining on the auction fees between the artist and the auction house, one bargaining between the insider and the auction house, two bargaining between the gallery and the auction house, one bargaining on the artwork prices between the artist and the insider, one between the artist and the gallery, one between the insider and the gallery, and two bargaining between the gallery and the outsider. Furthermore, the supply and the demand channels give rise to three types of markets where artworks can be traded: the primary markets with three channels (artist–auction house (ah), artist–insider (ai), and artist–gallery (ag)); the secondary markets with four channels (artist–

the author, as well as to have attended an art school; this art capital could be increased through a learning process, however, as pointed out by Stigler and Becker (1977).

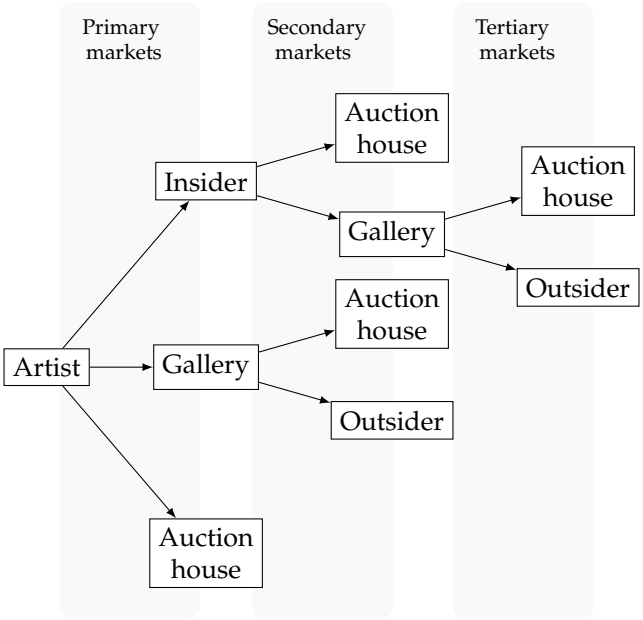


Figure 2.2: Reduced set of potential bargaining

gallery–auction house (agh), artist–insider–auction house (aih), artist–insider–gallery (aig), and artist–gallery–outsider (ago)); the tertiary markets with two channels (artist–insider–gallery–outsider ($aigo$) and artist–insider–gallery–auction house ($aigh$)). In Figure 2.2, we graphically show all the relations between the five agents in each market and in every channel.

Given the artist's, the bidders', and the outsiders' reserve prices (respectively, P_R^a, P_R^b, and P_R^o), in each market there are multiple bargaining prices P_{Bj}^k, where k indicates the pair of agents participating in the bargaining and j is the channel where the trade takes place. Furthermore, galleries can post a price P_G

for each artwork that these dealers hold in stock and there is a unique auction price P_A, assuming that the auctioneer guarantees the sale price to attract valuable artworks by covering the seller's risk of unsold.[12] In Table 2.1, we report all prices defined above.

To model bargaining prices, we use a simple Nash bargaining game where each pair of agents simultaneously play a bargaining game on the artwork price,[13] assuming that auction prices guarantee are common knowledge and exogenously given, such that:

$$0 < P_R^a < P_A < P_R^b \tag{2.1}$$

In particular, we assume that agents have rational expectations and that artists, galleries, auction houses, and insiders have also perfect information, while outsiders, having imperfect information, can only buy artworks from galleries since they only know the gallery's posted prices. Thus the artist's and the bidder's reserve price are, respectively, the minimum and the maximum price of artworks, while the auction price guarantee is always greater than the artist's reserve price and

[12] If the higher bidder's reserve price is less than the seller's reserve price, an artwork is unsold ("bought-in") (Ashenfelter, 1989; Ashenfelter and Graddy, 2003). In case of "bought-in" or if an artwork's auction price is lower than the guarantee price, the auction house buys the artwork for the guarantee price. Once the auction house is the owner of the artwork (just as a gallery), the auctioneer has to find a potential buyer with a reserve price at least equal to the guarantee price, or, before the auction, the auctioneer has to find a third-party guarantee (guarantor) who agrees to pay the guarantee price through an irrevocable bid. Thus, if the auction price is higher than the guarantee price, the seller and the guarantor share the difference between the auction price and the guarantee price after the buyer paid the auction fee (Graddy and Hamilton, 2014).

[13] This mechanism assures that all the choices that are made are efficient; at the same time, it guarantees that, given the bargaining powers, each agent will maximize his surplus.

less than the bidder's reserve price, given that the auction fees are not null. Moreover, when auctioning and bargaining are not costly, the galleries' problem is to post a price P_G for each artwork, which is solved posting it equal to the maximum between the auction price guarantee and the outsider's reserve price.[14]

In order to make the hypothesis of imperfect information more effective for the outsiders and to emphasise the role of galleries, we crucially assume that outsiders never buy at auction:

$$P_R^o < P_R^b \tag{2.2}$$

On the other hand, we simplify the gallery's posted-price problem assuming that:

$$P_G = P_A = P_R^o \tag{2.3}$$

[14]It is easy to prove that the maximization problem we solve for the bargaining between the gallery and the outsider is equivalent to a minimization of the discount applied to a posted price, assuming that the bargaining power of the gallery in the former problem is equal to the complement to one of the gallery's bargaining power in the latter, that is, the problem is dual. Actually, the minimization problem for the gallery in discounting the posted price is equivalent to the minimization problem for the outsider in the bargaining problem with the gallery.

Table 2.1: Nomenclature (prices)

P_R^a	is the artist's reserve price
P_R^b	is the bidder's reserve price
P_R^o	is the outsider's reserve price
P_G	is the gallery's posted price
P_A	is the auction price guarantee
P_{Bj}^k	is the bargaining price between the agents k in the channel j (from now on P_j^k)
P_{ah}^{ah}	is the bargaining price when the artist and the auction house bargain in the primary market
P_j^{ag}	is the bargaining price when the artist and the gallery bargain in the primary market and channel $j = agh, ago$
P_j^{ai}	is the bargaining price when the artist and the insider bargain in the primary market and channel $j = aigh, aigo, aih$
P_j^{ig}	is the bargaining price when the insider and the gallery bargain in the secondary market and channel $j = aigh, aigo$
P_{aih}^{ih}	is the bargaining price when the insider and the auction house bargain in the secondary market
P_{agh}^{gh}	is the bargaining price when the gallery and the auction house bargain in the secondary market
P_{ago}^{go}	is the bargaining price when the gallery and the outsider bargain in the secondary market
P_{aigo}^{go}	is the bargaining price when the gallery and the outsider bargain in the tertiary market
P_{aigh}^{gh}	is the bargaining price when the gallery and the auction house bargain in the tertiary market

Since the bargaining power of each agent is the relative ability to influence over each other, in Table 2.2 we define a measure of relative bargaining power of every agent for each bargaining game, assuming that the seller's bargaining power (market power), that lays strictly between 0 and 1, is the complement to one of the buyer's bargaining power (buying power).[15] These market powers in first approximation are assumed to be exogenous variables, but they could vary thanks to shocks on observable or latent variables: for example, a positive shock on artist's fame will increase her market power towards all the other agents she may interact with; similarly, a decrease in the market concentration of the galleries will very likely decrease the galleries' market power towards both the auction house and the outsiders, as well as towards both the artist and the insiders.

Table 2.2: Nomenclature (bargaining powers)

α	is the artist's bargaining power versus the insider on P_j^{ai}, $j = aih, aigh, aigo$
$1-\alpha$	is the insider's bargaining power versus the artist on P_j^{ai}, $j = aih, aigh, aigo$
β	is the artist's bargaining power versus the gallery on P_j^{ag}, $j = agh, ago$
$1-\beta$	is the gallery's bargaining power versus the artist on P_j^{ag}, $j = agh, ago$
γ	is the insider's bargaining power versus the gallery on P_j^{ig}, $j = aigh, aigo$
$1-\gamma$	is the gallery's bargaining power versus the insider on P_j^{ig}, $j = aigh, aigo$
δ	is the gallery's bargaining power versus the outsider on P_j^{go}, $j = ago, aigo$
$1-\delta$	is the outsider's bargaining power versus the gallery on P_j^{go}, $j = ago, aigo$
μ	is the insider's bargaining power versus the auction house on P_{aih}^{ih}
$1-\mu$	is the auction house's bargaining power versus the insider on P_{aih}^{ih}
ν	is the gallery's bargaining power versus the auction house on P_j^{gh}, $j = agh, aigh$
$1-\nu$	is the auction house's bargaining power versus the gallery on P_j^{gh}, $j = agh, aigh$
η	is the artist's bargaining power versus the auction house on P_{ah}^{ah}
$1-\eta$	is the auction house's bargaining power versus the artist on P_{ah}^{ah}

[15] For an analysis of the theory of supply chain intermediation and efficiency within a bargaining theoretic framework, see Wu (2004).

2.3.1 Tertiary market

We now introduce the problems and the solutions of the bargaining games we described above.

aigh **channel**

In the bargaining between the gallery and the auction house on the $aigh$ channel, the gallery with a bargaining power equal to ν faces the following problem:

$$\max_{P^{gh}_{aigh}} \left[\left(P^{gh}_{aigh} - P^{ig}_{aigh} \right)^{\nu} \left(P_A - P^{gh}_{aigh} \right)^{1-\nu} \right] \tag{2.4}$$

which is solved for:

$$P^{gh}_{aigh} = (1-\nu) P^{ig}_{aigh} + \nu P_A \tag{2.5}$$

Given (2.1) and (2.3), we have:

$$P^{gh}_{aigh} = (1-\nu) P^{ig}_{aigh} + \nu P^{o}_{R} \tag{2.6}$$

aigo **channel**

In the bargaining between the gallery and the outsider, where δ is the gallery's bargaining power, the bargaining price is obtained from the following maximization:

$$\max_{P^{go}_{aigo}} \left[\left(P^{go}_{aigo} - P^{ig}_{aigo} \right)^{\delta} \left(P^{o}_{R} - P^{go}_{aigo} \right)^{1-\delta} \right] \tag{2.7}$$

which is solved for:

$$P^{go}_{aigo} = (1-\delta) P^{ig}_{aigo} + \delta P^{o}_{R} \tag{2.8}$$

2.3.2 Secondary market

agh **channel**

In the bargaining between the gallery and the auction house, the gallery with a bargaining power equal to ν faces the following problem:

$$\max_{P_{agh}^{gh}} \left[\left(P_{agh}^{gh} - P_{agh}^{ag} \right)^{\nu} \left(P_A - P_{agh}^{gh} \right)^{1-\nu} \right] \tag{2.9}$$

that, given assumptions in (2.1) and (2.3), is solved for:

$$P_{agh}^{gh} = (1-\nu) P_{agh}^{ag} + \nu P_R^o \tag{2.10}$$

ago **channel**

In the bargaining between the gallery and the outsider, δ is still the gallery's bargaining power, and the problem it faces is the following:

$$\max_{P_{ago}^{go}} \left[\left(P_{ago}^{go} - P_{ago}^{ag} \right)^{\delta} \left(P_R^o - P_{ago}^{go} \right)^{1-\delta} \right] \tag{2.11}$$

that is solved for:

$$P_{ago}^{go} = (1-\delta) P_{ago}^{ag} + \delta P_R^o \tag{2.12}$$

aih **channel**

In the bargaining between the insider and the auction house, the bargaining is on the price the insider will receive from the auction house; his bargaining power is equal to μ, and he faces

the following maximization problem:

$$\max_{P_{aih}^{ih}} \left[\left(P_{aih}^{ih} - P_{aih}^{ai} \right)^{\mu} \left(P_A - P_{aih}^{ih} \right)^{1-\mu} \right] \tag{2.13}$$

The maximizing price, given (2.1) and (2.3), is:

$$P_{aih}^{ih} = (1-\mu) P_{aih}^{ai} + \mu P_R^o \tag{2.14}$$

$aigh$ and $aigo$ channel

Here, in the bargaining between the insider and the gallery, the insider knows if the gallery will sell the artwork to the auction house or the the outsider once it has bought it. Hence, given that the bargaining power of the insider is equal to γ, he faces the following generalized maximization problem:

$$\max_{P_l^{ig}} \left[\left(P_l^{ig} - P_l^{ai} \right)^{\gamma} \left(P_l^{w} - P_l^{ig} \right)^{1-\gamma} \right] \tag{2.15}$$

where $l = aigh, aigo$, and $w = gh$ if $l = aigh$, while $w = go$ if $l = aigo$. The maximizing price is:

$$P_l^{ig} = (1-\gamma) P_l^{ai} + \gamma P_l^{w} \tag{2.16}$$

If $l = aigh$, and hence $w = gh$, we have:

$$P_{aigh}^{ig} = (1-\gamma) P_{aigh}^{ai} + \gamma P_{aigh}^{gh} \tag{2.17}$$

If, instead, $l = aigo$, and hence $w = go$, the price in (2.16) can be rewritten as:

$$P_{aigo}^{ig} = (1-\gamma) P_{aigo}^{ai} + \gamma P_{aigo}^{go} \tag{2.18}$$

2.3.3 Primary market

ah channel

In the bargaining between the artist and the auction house, the artist bargains directly with the auction house on the price of her artwork and her bargaining power is equal to η, so that the problem she faces is the following:

$$\max_{P_{ah}^{ah}} \left[\left(P_{ah}^{ah} - P_R^a \right)^{\eta} \left(P_A - P_{ah}^{ah} \right)^{1-\eta} \right] \tag{2.19}$$

that, given assumption in (2.1) and (2.3), is solved for:

$$P_{ah}^{ah} = (1-\eta) P_R^a + \eta P_R^o \tag{2.20}$$

aih, $aigh$ and $aigo$ channels

In all three bargainings between the artist and the insider, the artist, having a bargaining power equal to α, faces the following generalized problem:

$$\max_{P_k^{ai}} \left[\left(P_k^{ai} - P_R^a \right)^{\alpha} \left(P_k^z - P_k^{ai} \right)^{1-\alpha} \right] \tag{2.21}$$

where $k = aigh, aigo, aih$ and $z = ig$ if $k = aigh, aigo$ and $z = ih$ if $k = aih$. The maximizing price is given by:

$$P_k^{ai} = (1-\alpha) P_R^a + \alpha P_k^z \tag{2.22}$$

If $k = aigh$, and hence $z = ig$, we can rewrite (2.22) as:

$$P_{aigh}^{ai} = (1-\alpha) P_R^a + \alpha P_{aigh}^{ig} \tag{2.23}$$

If, instead, $k = aigo$, (2.22) becomes:

$$P^{ai}_{aigo} = (1-\alpha)P^{a}_{R} + \alpha P^{ig}_{aigo} \tag{2.24}$$

Finally, if $k = aih$, and hence $z = ih$, we have:

$$P^{ai}_{aih} = (1-\alpha)P^{a}_{R} + \alpha P^{ih}_{aih} \tag{2.25}$$

agh **and** ago

In the bargaining between the artist and the gallery, the artist knows if the gallery will sell the artwork to the auction house or to the outsider. The artist's bargaining power is β, and she faces the following generalized maximization problem:

$$\max_{P^{ag}_{j}} \left[\left(P^{ag}_{j} - P^{a}_{R} \right)^{\beta} \left(P^{y}_{j} - P^{ag}_{j} \right)^{1-\beta} \right] \tag{2.26}$$

where $j = agh, ago$, and $y = gh$ when $j = agh$, while $y = go$ when $j = ago$. The problem in (2.26) is solved for:

$$P^{ag}_{j} = (1-\beta)P^{a}_{R} + \beta P^{y}_{j} \tag{2.27}$$

If $j = agh$, and hence $y = gh$, we can rewrite (2.27) as:

$$P^{ag}_{agh} = (1-\beta)P^{a}_{R} + \beta P^{gh}_{agh} \tag{2.28}$$

If, instead, $j = ago$ and $y = go$, we have:

$$P^{ag}_{ago} = (1-\beta)P^{a}_{R} + \beta P^{go}_{ago} \tag{2.29}$$

2.3.4 The gallery's and the insider's choices

We present now the results for the secondary and tertiary market.

Lemma 2.1 *Whatever the price the gallery pays to buy the artwork, the gallery will prefer to sell the artwork to the auction house rather than to sell it to the outsider if and only if:*

$$\nu > \delta \tag{2.30}$$

Proof. See Appendix A.1. ■

Lemma 2.2 *Whatever the price the gallery pays to buy the artwork, it will be sold to the outsider if and only if:*[16]

$$\nu < \delta \tag{2.31}$$

Proof. See Appendix A.2. ■

In summary, the choice of the gallery is only based on its ability in the bargaining process with the potential buyers. In fact, it is likely that the gallery can exploit its market power versus the outsider in a more effective way than what it could do with the auction house, since the auction houses are more informed than outsiders and the auction houses' market is less concentrated than the galleries' one. Hence, an artwork that reaches a gallery is more likely to be sold to an outsider than to be sold to an auction house, and thus the bargaining should prevail on auctioning. However, this last conjecture should be empirically tested on prices and market powers data, though there is a lack of data on this shadow market.

Lemma 2.3 *Given Lemma 2.1, whatever the price the insider pays to buy the artwork, he will sell it to the auction house instead of selling*

[16] A similar reasoning can be applied to the case when $\delta = \nu$, but we do not report it since it is trivial. In particular, also in the following Lemmas and Propositions we will not consider the cases of indifference, namely when the conditions present the equality sign.

it to the gallery if and only if:

$$\mu > \frac{\nu\gamma}{1-\gamma(1-\nu)} \tag{2.32}$$

Proof. See Appendix A.3. ■

Lemma 2.4 *The insider will sell the artwork to the gallery instead of to the auction house, whatever the price he paid and given Lemma 2.1, if and only if:*

$$\mu < \frac{\nu\gamma}{1-\gamma(1-\nu)} \tag{2.33}$$

Proof. See Appendix A.4. ■

Lemma 2.5 *Given Lemma 2.2, whatever the price the insider pays to buy the artwork, he will sell it to the auction house instead of selling it to the gallery if and only if:*

$$\mu > \frac{\delta\gamma}{1-\gamma(1-\delta)} \tag{2.34}$$

Proof. See Appendix A.5. ■

Lemma 2.6 *The insider will sell the artwork to the gallery, whatever the price he paid and given Lemma 2.2, if and only if:*

$$\mu < \frac{\delta\gamma}{1-\gamma(1-\delta)} \tag{2.35}$$

Proof. See Appendix A.6. ■

To sum up, the dominance of the bargaining over the auctioning in the choice of the insider depends on a comparison between the insider's market power against the auction house and his market power against the gallery, weighted for the market power of the gallery in the potential step forward. Given the fact that the insider collector is not a professional agent, one

could reasonably expect that the auction house has a high ability in the bargaining process with this agent. Hence, it is likely that the artwork will be sold to the gallery by the insider. Furthermore, one could expect that, in the bargaining between the gallery and the insider, the former, being a professional agent, will be able to exploit its market power to gain more than half of the price spread, that is, gallery's market power is likely to be higher than insider's one; currently, the lack of data prevents us to test this hypothesis.

2.3.5 The artist's choice

In this subsection we present the main results for the primary market.

Proposition 2.1 *Given Lemma 2.3, the artist has to choose between selling the artwork to the auction house, selling it to the insider (knowing that he will sell the artwork to the auction house if he buys it), and selling it to the gallery (which will sell the artwork to the auction house, once the gallery has bought it). The conditions on the parameters for each of these choices to be selected, choosing among the prices in* (2.20), (2.25), *and* (2.28) *are the following:*

2.1.1 *The artist sells to the insider* ($aih \succ agh \wedge aih \succ ah$) *if and only if:*

$$\eta < \frac{\alpha\mu}{1-\alpha(1-\mu)} \wedge \beta < \frac{\alpha\mu}{\alpha\mu+\nu(1-\alpha)} \tag{2.36}$$

2.1.2 *The artist sells to the gallery* ($agh \succ aih \wedge agh \succ ah$) *if and only if:*

$$\eta < \frac{\beta\nu}{1-\beta(1-\nu)} \wedge \beta > \frac{\alpha\mu}{\alpha\mu+\nu(1-\alpha)} \tag{2.37}$$

2.1.3 *The artist sells to the auction house ($ah \succ aih \wedge ah \succ agh$) if and only if:*

$$\eta > \frac{\beta\nu}{1-\beta(1-\nu)} \wedge \eta > \frac{\alpha\mu}{1-\alpha(1-\mu)} \tag{2.38}$$

Proof. See Appendix A.7. ■

Proposition 2.2 *Given Lemma 2.4, the artist has to choose between selling her artwork to the auction house, selling it to the gallery knowing that it will be sold to the auction house, and selling it to the insider, knowing that he will sell it to the gallery and, then, the gallery will sell it to the auction house. Hence, the three prices among which the artist has to choose are those in* (2.20)*, in* (2.23)*, and in* (2.28)*. Thus, we have the following conditions for the three possible choices:*

2.2.1 *The artist sells to the insider ($aigh \succ agh \wedge aigh \succ ah$) if and only if:*

$$\begin{aligned} \eta < \frac{\alpha\gamma\nu}{1-\alpha(1-\gamma)-\gamma(1-\nu)} \wedge \\ \wedge\, \beta < \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\nu))-\gamma(1-\nu)} \end{aligned} \tag{2.39}$$

2.2.2 *The artist sells to the gallery ($agh \succ aigh \wedge agh \succ ah$) if and only if:*

$$\eta < \frac{\beta\nu}{1-\beta(1-\nu)} \wedge \beta > \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\nu))-\gamma(1-\nu)} \tag{2.40}$$

2.2.3 *The artist sells to the auction house ($ah \succ aigh \wedge ah \succ agh$) if and only if:*

$$\eta > \frac{\beta\nu}{1-\beta(1-\nu)} \wedge \eta > \frac{\alpha\gamma\nu}{1-\alpha(1-\gamma)-\gamma(1-\nu)} \tag{2.41}$$

Proof. See Appendix A.8. ■

Proposition 2.3 *Given Lemma 2.5, the artist has to choose between selling her artwork to the auction house, selling it to the gallery knowing that it will be sold to the outsider, and selling it to the insider, knowing that he will sell it to the auction house. Hence, the three prices among which the artist has to choose are those in* (2.20)*, in* (2.25)*, and in* (2.29)*. The conditions for which each of the three prices is chosen are the following ones:*

2.3.1 *The artist sells to the insider* $(aih \succ ago \wedge aih \succ ah)$ *if and only if:*

$$\eta < \frac{\alpha\mu}{1-\alpha(1-\mu)} \wedge \beta < \frac{\alpha\mu}{\alpha\mu+\delta(1-\alpha)} \tag{2.42}$$

2.3.2 *The artist sells to the gallery* $(ago \succ aih \wedge ago \succ ah)$ *if and only if:*

$$\eta < \frac{\beta\delta}{1-\beta(1-\delta)} \wedge \beta > \frac{\alpha\mu}{\alpha\mu+\delta(1-\alpha)} \tag{2.43}$$

2.3.3 *The artist sells to the auction house* $(ah \succ aih \wedge ah \succ ago)$ *if and only if:*

$$\eta > \frac{\beta\delta}{1-\beta(1-\delta)} \wedge \eta > \frac{\alpha\mu}{1-\alpha(1-\mu)} \tag{2.44}$$

Proof. See Appendix A.9. ■

Proposition 2.4 *Given Lemma 2.6, the artist has to choose between selling her artwork to the auction house, selling it to the gallery knowing that it will be sold to the outsider, and selling it to the insider, knowing that the artwork will be sold to the outsider passing by the gallery. The prices among which the artist has to choose are those on* (2.20)*,* (2.24)*, and* (2.29)*. The parameter loci in which each of the possible choice is the preferred one are the following:*

2.4.1 *The artist sells to the insider* $(aigo \succ ago \wedge aigo \succ ah)$ *if and*

only if:

$$\begin{aligned} \eta < \frac{\alpha\gamma\delta}{1-\alpha(1-\gamma)-\gamma(1-\delta)} \wedge \\ \wedge\, \beta < \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\delta))-\gamma(1-\delta)} \end{aligned} \tag{2.45}$$

2.4.2 *The artist sells to the gallery ($ago \succ aigo \wedge ago \succ ah$) if and only if:*

$$\eta < \frac{\beta\delta}{1-\beta(1-\delta)} \wedge \beta > \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\delta))-\gamma(1-\delta)} \tag{2.46}$$

2.4.3 *The artist sells to the auction house ($ah \succ aigo \wedge ah \succ ago$) if and only if:*

$$\eta > \frac{\beta\delta}{1-\beta(1-\delta)} \wedge \eta > \frac{\alpha\gamma\delta}{1-\alpha(1-\gamma)-\gamma(1-\delta)} \tag{2.47}$$

Proof. See Appendix A.10. ■

Once the artwork has been created, the artist chooses what is the path through which the artwork will reach the public market, maximizing her artwork's price and hence her surplus. This is done considering all the market powers of all the agents, and hence all the agents' optimal choices that could or will follow the artist's choice. The dominance of a certain path on the others depends on the relative ability of the artist to bargain against each of the potential buyers, in the current step (the primary market), and on the bargaining powers of the other agents in the following steps (the secondary and tertiary market), only in the cases in which they are reached. In particular, the choice on which path to follow is based on a comparison of the relative market powers of the artist "discounted" by the market powers of all the agents that will operate in each path,

that is, considering the fall-back positions she faces.
In Table 2.3 we report the necessary and sufficient conditions such that each of the path can be observed.

Finally, the artist's choice will lead to a set of equilibrium prices, since each path will have a set of at least one equilibrium price, that will depend on the market powers of the agents on the chosen path only. In the following section we perform a comparative statics analysis.

Table 2.3: Conditions for the emergence of each path

Paths	*iff*
ah	$\nu > \delta \wedge \eta > \frac{\beta\nu}{1-\beta(1-\nu)} \wedge \begin{array}{l} \mu > \frac{\nu\gamma}{1-\gamma(1-\nu)} \wedge \eta > \frac{\alpha\mu}{1-\alpha(1-\mu)} \\ \hline \mu < \frac{\nu\gamma}{1-\gamma(1-\nu)} \wedge \eta > \frac{\alpha\gamma\nu}{1-\alpha(1-\gamma)-\gamma(1-\nu)} \end{array}$
	$\nu < \delta \wedge \eta > \frac{\beta\delta}{1-\beta(1-\delta)} \wedge \begin{array}{l} \mu > \frac{\delta\gamma}{1-\gamma(1-\delta)} \wedge \eta > \frac{\alpha\mu}{1-\alpha(1-\mu)} \\ \hline \mu < \frac{\delta\gamma}{1-\gamma(1-\delta)} \wedge \eta > \frac{\alpha\gamma\delta}{1-\alpha(1-\gamma)-\gamma(1-\delta)} \end{array}$
ago	$\nu < \delta \wedge \eta < \frac{\beta\delta}{1-\beta(1-\delta)} \wedge \begin{array}{l} \mu > \frac{\delta\gamma}{1-\gamma(1-\delta)} \wedge \beta > \frac{\alpha\mu}{\alpha\mu+\delta(1-\alpha)} \\ \hline \mu < \frac{\delta\gamma}{1-\gamma(1-\delta)} \wedge \beta > \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\delta))-\gamma(1-\delta)} \end{array}$
agh	$\nu > \delta \wedge \eta < \frac{\beta\nu}{1-\beta(1-\nu)} \wedge \begin{array}{l} \mu > \frac{\nu\gamma}{1-\gamma(1-\nu)} \wedge \beta > \frac{\alpha\mu}{\alpha\mu+\nu(1-\alpha)} \\ \hline \mu < \frac{\nu\gamma}{1-\gamma(1-\nu)} \wedge \beta > \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\nu))-\gamma(1-\nu)} \end{array}$
aih	$\eta < \frac{\alpha\mu}{1-\alpha(1-\mu)} \wedge \begin{array}{l} \nu > \delta \wedge \mu > \frac{\nu\gamma}{1-\gamma(1-\nu)} \wedge, \beta < \frac{\alpha\mu}{\alpha\mu+\nu(1-\alpha)} \\ \hline \nu < \delta \wedge \mu > \frac{\delta\gamma}{1-\gamma(1-\delta)} \wedge \beta < \frac{\alpha\mu}{\alpha\mu+\delta(1-\alpha)} \end{array}$
aigo	$\nu < \delta \wedge \mu < \frac{\delta\gamma}{1-\gamma(1-\delta)} \wedge \eta < \frac{\alpha\gamma\delta}{1-\alpha(1-\gamma)-\gamma(1-\delta)} \wedge \beta < \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\delta))-\gamma(1-\delta)}$
aigh	$\nu > \delta \wedge \mu < \frac{\nu\gamma}{1-\gamma(1-\nu)} \wedge \eta < \frac{\alpha\gamma\nu}{1-\alpha(1-\gamma)-\gamma(1-\nu)} \wedge \beta < \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\nu))-\gamma(1-\nu)}$

2.3.6 Comparative statics

In this section we study how the prices changes as the market's power levels change. In analysing the effect of a change in the bargaining power on a certain price, we first consider only changes in the parameters that will make the conditions under which the price is observed to still hold also after the changes. In other words, if the price P_y is observed, it is because a certain parameter x that enters its expression respects the condition to be on path y, for example $x < \bar{x}$; if we want to study what is the effect of a change in x on P_y, that is, $\frac{dP_y}{dx}$, we need to have that $x + dx < \bar{x}$, otherwise we could incur in a change of the path in the game modeled in this section and, hence, in the occurrence of a price different from P_y.
Assuming that the condition we just mentioned holds, one can demonstrate that all the equilibrium prices of each step and in each possible path are increasing in the parameters of bargaining power that appear in their expressions.
Observing the closed-form expressions of the various prices (see Appendix A), one can see that their formulas vary depending on how many steps there are in the path to which the price is referred and what is its position in this path. Considering the number of steps in the path, we can distinguish among three different paths:

- Paths with only one step (ah)
- Paths with two steps (aih, ago, and agh)
- Paths with three steps ($aigh$ and $aigo$)

Another distinction is based on the position of the considered price on the path in which it is observed, that is:

1. Prices in a one-step path (that is, P_{ah}^{ah} in the ah path)

2. Prices in a two-step path with a further step in front (that is, P_{aih}^{ai} in the aih path, and P_{ago}^{ag} and P_{agh}^{ag} in the ago and agh paths)

3. Prices in a two-step path with no further steps in front (that is, P_{aih}^{ih} in the aih path, and P_{ago}^{go} and P_{agh}^{gh} in the ago and agh paths)

4. Prices in a three-step path with two further steps in front (that is, P_{aigh}^{ai} in the $aigh$ path, and P_{aigo}^{ai} in the $aigo$ path)

5. Prices in a three-step path with a step behind and a further step in front (that is P_{aigh}^{ig} in the $aigh$ path, and P_{aigo}^{ig} in the $aigo$ path)

6. Prices in a three-step path with two steps behind (that is P_{aigh}^{gh} in the $aigh$ path, and P_{aigo}^{go} in the $aigo$ path)

From a first analysis of all these prices, we can easily see that all of them have a similar structure, that is:

$$P_x = (1 - \xi)P_z + \xi P_y$$

where ξ is the bargaining power of the considered agent, P_z is either his purchasing price (if the agent is a gallery or an insider) or his reserve price (if he is an artist), and P_y is either the reserve price of the outsider (if the seller is the gallery, or the artist when facing the auction house, or the insider when facing the auction house, by assumption (2.3)) or simply the price that will be obtained in the following step (if the seller is the artist when facing the gallery or the insider, or the insider when facing the gallery). Given how we built the model, we

have that $P_y > P_z$, and hence P_x is increasing in ξ.
So, all the prices that appears in Section 2.3 are increasing in the parameter that appears in them, but this implies that their closed form, as they result in Appendix A, are increasing in all the parameters that appear in them as well.
The explanation of this result is as follows: since both the lower and the upper bound of the interval over which the bargaining of each of the prices is made are increasing in the parameters that appear in them, as well as the price itself is increasing in the parameter it has inside it, an increase in each of the parameters that appears in each price formula have an increasing effect on it, assumed that these changes in the parameters do not change the validity of the condition under which the price is observed.

However, a change in a parameter could also make one or more than one of the conditions to not hold anymore, that is, it could change the path the artwork will follow; this is due to the effect a parameter have on the equilibrium price of each of the path, and hence could change the choice of the agents. For example, assuming conditions (2.30), (2.32), and (2.38) hold, that is, assuming the artwork is in the ah path, a reduction in η such that $\eta > \frac{\beta\nu}{1-\beta(1-\nu)}$ does not hold anymore, but $\eta > \frac{\alpha\mu}{1-\alpha(1-\mu)}$ still holds (that is, $\frac{\beta\nu}{1-\beta(1-\nu)} > \frac{\alpha\mu}{1-\alpha(1-\mu)}$) will imply that the artwork will pass to the agh path; if instead η changes such that $\frac{\beta\nu}{1-\beta(1-\nu)}$ still hold, while $\frac{\alpha\mu}{1-\alpha(1-\mu)}$ does not hold anymore, the artwork will pass to the aih path.
If we assume that the artwork is in the ago path, that is, that conditions (2.31), (2.35), and (2.46) hold, a reduction in β such that $\beta > \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\delta))-\gamma(1-\delta)}$ does not hold anymore will make the artwork pass through path $aigo$ instead.

These examples we presented depict how a particular agent could emerge in the path the artwork will follow, due to the effect this agent has on the equilibrium price of this path: an artist will find profitable to sell her artwork to the insider as her market power towards the auction house decreases, while her market power against the gallery is not high enough; the emergence of the insider within the ago path, transforming it in $aigo$, can be explained with a similar argument.

It is worth noting that all the analysis carried through in this subsection assume the *ceteris paribus* condition, that is, a change in one of the parameter is not associated to the change of any of the other parameters.

2.4 Conclusions

In this paper, we presented a Nash bargaining model of the private art market in which the new artworks are traded, to explain its functioning and characterize the main relationships between the agents that operate in this shadow market. In our model, the artist creates the artwork and sells it in the primary market, in which insider collectors and galleries operates; the insiders can resell the artwork to the gallery in the secondary market, and the gallery can resell it, both in the secondary and in the tertiary market, to the outsider collector, depending on the market in which the artwork has been bought; all these agents, besides the outsider collectors, can also sell the artwork in the public market, through the intermediation of an auction house.

Using the bargaining selling method as actual price mechanism formation in art trades, we represent the agents' simultaneous

choices through the market channels in the private art market of new artworks. In particular, we identified a set of bargain equilibrium prices in each possible market channel. All the equilibrium prices are path-dependent and are positively affected by any increase of the market powers of the agents in the path in which the price is observed.

With our bargaining games, we can fully characterize the market conditions for which an artwork ends up to be sold in a gallery or at auction, eventually with the intermediation of other agents, as an insider collector, too. In this way, we defined the artist's optimal incentive in creating a new artwork, since she is able to perfectly identify the private price at which her artwork will be sold. Furthermore, we are able to explain both the role of the gallery in the price formation in the private market and its incentives to operate in the art market.

Our setting provides an ideal framework of this market that could be used to test the efficiency of the Artist Re-sale Rights (the royalty an artist could receive when her artwork is resold through a dealer), as well as other public interventions in the art market to support one or more agents/paths. When the data will be available on private market, the testable implications of our model could be carried through, not only as an empirical validation of the results, but also as a way to identify the dominant paths in the real shadow art market.

However, our framework can also be adopted to analyze the market of patents, where the inventor would take the role of the artist, the gallery would be replaced by a patent broker, the auction house by the agents who sell the patents in auction, that are recently emerged in the market of the intellectual prop-

erty,[17] while the insider and the outsider would be replaced respectively by a more and a less informed firm.

[17]For an analysis of patent brokerage firms, intellectual property auctions, and other intermediaries in the intellectual property market, see Hagiu and Yoffie (2013).

Chapter 3

Value and information in the art market: A behavioural pricing model

3.1 Introduction

Talking about prices in the art market should be done considering the role that information and value play in the artworks' price-formation mechanism. Many scholars from humanities vastly studied the value issue in the art, and the information issue in economics has been addressed even by Nobel prizes; however, when humanists study the value of cultural goods they often neglect the asymmetric information issue among the agents, while when economists study the information asymmetry question they usually ignore the role played by the cultural

value in the cultural goods' market.
In fact, cultural goods have the peculiarity to embody both a cultural and an economic value, and the agents that operate in the cultural goods' markets usually have a different level of available information on these two values. Hence, the two issues are closely related and should not be studied separately. To date, few cultural economists have considered together the two questions in the same framework, using theories from economics and concepts from humanities, but always without a pure analytical approach. For this reason, we propose a new theoretical model of pricing, based on Chapter 2, to take into account both the information and value issues in the cultural goods' market. Starting from the artist's choice about selling her artwork, we model the relationships among the galleries' and collectors' actions in the private market depending on the information at their disposal and on their ability in evaluating the cultural and economic value of the artwork itself. In particular, using a bargaining theoretical framework developed by Wu (2004), we analyze two of the channels of the private art market we proposed in 2, through which the new artwork created by the artist may reach a collector with the intermediation of a gallery, and study what is the role of information and value in the formation of the price of an artwork in these channels.
The remainder of the paper is organized as follows: in Section 3.2 we present a detailed literature review on both value of cultural goods (Subsection 3.2.1) and information asymmetry in cultural goods' markets (Subsection 3.2.2). In Section 3.3, we briefly summarize the results of the model from 2 and in Section 3.4 we develop the new model considering both artist's talent and fame and information issue on quality of the artworks.

In Section 3.5 we discuss the main results of our model. Section 3.6 concludes the paper.

3.2 State of the Art

In art markets, as well as in general, the price has a double meaning: it works as an index of value of the good, and it is an important information signal of quality. However, when studying the art market, the value and the information deserve particular attention, given the higher number of issues that one should deal with. For this reason, understanding the price-formation mechanism of art goods is key. While there exists a vast number of qualitative contributions on this topic in literature (see, for example, Velthuis, 2007), the theoretical analysis of the price mechanism in the art market lacks of attention, besides the works by Shubik (2003) and by Schönfeld and Reinstaller (2007), as well as the model in Chapter 2 of this dissertation; furthermore, all these works overlooked the role of information in the art market and of value of cultural goods. In order to take into account these two important features of the art market, we first present the state of the art of the literature on the value and the evaluation of cultural goods (Subsection 3.2.1) and on the asymmetric information issue in the art market (Subsection 3.2.2).

3.2.1 On value of cultural goods

There are several possible definitions of cultural good in literature; for example, Throsby (2001) defines the three main characteristics a cultural good should have to be called such: "that the activities concerned involve some form of creativity in their

production, that they are concerned with the generation and communication of symbolic meaning, and that their output embodies, at least potentially, some form of intellectual property" (p. 4),[1] while Klamer (2004) states that "[A cultural good] has cultural value in that it is a source of inspiration or symbol of distinction"(p. 138).

Defining the "value" of cultural goods, however, is a controversial issue, since these goods present both a cultural and economic value; while there exists a consensus on how economic value of cultural goods' can be evaluated, the evaluation of their cultural value is an open issue, which has recently been addressed by several cultural economists.[2]

One of the early contributions on the analysis of the cultural value in cultural economics is a work by Throsby (1990), in which the author addresses the problem of the valuation of the quality of an art piece (in particular, a theater play) given the difficulty in resuming the several facets of the quality in an index, and, hence, in measuring it. More recently, Throsby (2001, pp. 281–282) states that the cultural value is "multidimensional, unstable, contested, lacks a common unit of account, and may contain elements that cannot be easily expressed according to any quantitative or qualitative scale", and he decomposes this value in:[3]

- the aesthetic value, that concerns "properties of beauty, harmony, form, and other aesthetic characteristics of the

[1] The same work contains also a definition of the economic value of a cultural good, that is the value which "comprises any direct use values of the cultural good or service in question, plus whatever non-market values it may give rise to."

[2] For an analysis of evaluation methods of cultural goods' economic value, see Throsby (2001) and Snowball (2008).

[3] See Throsby (2001, pp. 28–29).

work" and to other possible elements, like "style, fashion and good or bad taste";

- the spiritual value, that is, the value given to a work of art because it has a "significance to the members of a religious faith, tribe or other cultural grouping", but also an importance which is secular-based and hence shared among all the individuals;

- the social value, the value linked to the sense of connection with others which the artwork transmits;

- the historical value, related to the way "it reflects the conditions of life at the time it was created";

- the symbolic value, which is linked to the ability of the artwork to convey a particular meaning, perceived by the individual through his reading of the artwork itself;

- the authenticity value, that is, the value that comes from the fact that the artwork is original.

These sub-values are explicitly said to be only a part of the constituent elements of the cultural value, although they can be considered the most important. Throsby's decomposition of the cultural value has been accepted, either implicitly or explicitly, within cultural economics literature, with only few exceptions, among which we have the contributions by Klamer (2004, 2008).[4] He highlights the presence of characteristics that are

[4]Also Smith (2008, pp. 36–38) presents an alternative view to Throsby's, introducing a totally new categorization of the types of artistic values, "each associated with the observable properties or the demonstrable effects of artworks". Specifically, these values are existent value, representation value, formative value, insight/idea value, transformatory value.

cultural goods-specific, linked to their ability of being "symbol of something", or to their "artistic, aesthetic, or sacred qualities", which, however, are not considered as components of the cultural value by the author; conversely, he states that an artistic good can be evaluated on the basis of three different, and mutually exclusive, values, that is:[5]

- the economic value, "the value that refers to the prices of things, or their exchange value";
- the social value, which operates "in the context of interpersonal relationships, groups, communities, and societies" (as, for example, "belonging, being a member of a group, identity, social distinction, freedom, solidarity, trust, tolerance, responsibility, love, friendship");
- the cultural value, that comprehends everything which is not part of social and economic values.

Lately, Hernando Calero and Campo Martínez (2016) present an alternative characterization of value and its components in the art market, based on literature from both economics and marketing, but also from other subjects, as psychology, history of art, philosophy, and sociology. The authors distinguish among four components of value in the art market, that in turn can be made up of different components; the hedonistic value, the economic value, the social-symbolic value, and the artwork brand value. In particular, the hedonistic value includes the aesthetic value, the emotional value, the ownership value, and the cognitive value; the economic value is composed by the investment value and the value linked to its being a "good

[5]See Klamer (2004, pp. 147-150).

legacy" for future generation, the value attributed by the prescribers, that is, by the experts, and the scientific value, linked to the authenticity and the origin of the artwork; the social-symbolic value, which is here linked to the status conferred by the ownership of the artwork, and the artwork brand value have not been decomposed in their components by the authors. The scale of value introduced by Hernando Calero and Campo Martínez (2016), and then tested empirically through qualitative and quantitative data, is centered on the concept of perception, and hence results to be different depending on the individual considered in the evaluation, while the Throsby's and the Klamer's views tend to be more objective; this does not mean that the component of cultural value introduced by Throsby are perceived in the same way by each individuals, but that these components are defined in an objective way, but they can be perceived differently by different individuals.

Following Throsby's view and using it as a benchmark, Table 3.1 reports other contributions from the cultural economics literature which addressed this issue providing a decomposition of the cultural value which is in line with Throsby's, but also add original components of the cultural value.

Table 3.1: Comparison among the benchmark decomposition of cultural value and alternative views

	Aesthetic value	Spiritual value*	Social value**	Historical value***	Symbolic value****	Authenticity value	Other values
Throsby (2001)	yes	yes	yes	yes	yes	yes	no
Throsby (2003)	yes	yes	-	yes	yes	yes	yes
Hutter and Shusterman (2006)	yes	yes	yes	yes	yes	-	yes
Dekker (2014)	yes	-	yes	yes	-	-	no
Throsby and Zednik (2014)	yes	yes	yes	yes	yes	-	yes

Components of the cultural value presented by Throsby (2001) and other scholars' views in accordance with Throsby's work. "yes" indicates that the work points out that the correspondent value exists (being it defined in the work itself or just recalled), "-" indicates that the value is not recalled in the paper. Hutter and Shusterman (2006) call some of the Throsby's values with alternative names, but from the definitions we are able to link together same value with different names, in particular: * Spiritual value is also called "Moral/Religious value", ** Social value is called "Social and Political value", *** Historical value comprehends both "Art-historical value" and "Art Cult value", and **** Symbolic value contains "Cognitive value", the value linked to "Expressiveness", and the one linked to "Communicative power".

The other components of the cultural value, besides those in Throsby (2001), are: the educational value (Throsby and Zednik, 2014, p. 88), that can be "identified in terms of the works role in the education of children"; the value linked to the significance of the good in influencing artistic trends (Throsby, 2003, p. 280); the integrity of the work of art (Throsby, 2003, p. 280); the experiential value (Hutter and Shusterman, 2006, p. 198), that is, the "directly satisfying or pleasurable experience" the good gives; the art-technical value (Hutter and Shusterman, 2006, p. 199), which "relates to the skill, technique, or technical innovation displayed by an artwork".

Other scholars addressed the value issue, even if they did not decompose the cultural value but focused more on the relationship between the economic and the cultural value (if any), or on possible empirical strategies to investigate this relationship. In the first years of the formation of this literature dialectics, the dichotomous distinction among economic value and cultural value was not explicitly stated, and a particular attention was paid to the "quality" of a artwork, more than to its cultural value (Throsby, 1990). One of the first contribution to the analysis of the cultural versus economic value issue was the book by Klamer (1996), "The Value of Culture", in which the author collected a series of works by various scholars, from the economics field as well as from other fields, as philosophy, anthropology, and sociology.[6] Bonus and Ronte (1997, p. 104), highlight the particular feature of the quality of an artwork of not being objectively judged, stating that "there is no way to establish the quality of a certain picture or oeu-

[6]Indeed, Klamer (2004) was partly anticipated by the contributes in this book.

vre", maybe overstating the difficulty that one can find in finding a proxy of this variable or of its components. The issue of the quality evaluation of an artwork has been treated by Ginsburgh and Weyers (1999), suggesting to decompose the work of art in "quantifiable characteristics", both subjectively and in an unanimous way, and applying their technique to the movies industry.[7] More recently, the same authors (Ginsburgh and Weyers, 2008) reprise the evaluation of the beauty of a work of art, identifying three "types of beauty" that can be evaluated and measured using tools typical of the economic analysis.

After the book by Throsby (2001), also Candela and Scorcu (2004) addressed the cultural versus economic value issue, calling the former "artistic merit": the idea is that the same object can be recognized to have an artistic merit (that is, a cultural value) depending on how it is considered by the public, by the experts, or by some other group of influence; there exists a relationship between the artistic merit and the economic value, also if the evaluation of the economic value of the object can be made also without considering its artistic merit.[8] This distinction, however, is not easy to make, since the two values are strongly correlated, and in some cases it is hard to value an object only for what concerns its artistic merit or its economic value. McCain (2006) distinguishes between economic and non-economic values; in particular, he reviews a series of

[7] Another empirical investigation on the quality assessment is the one presented by Chossat and Gergaud (2003), which use the experts official judgments to quantify the quality of gastronomy. Tobias (2004) analyses the relationship between the expert opinion in the performing arts as a proxy of the quality and the economic variable, such as production costs.

[8] The authors bring the example of the artwork "*ballet français*" by Man Ray, pointing out that one could abstract the artistic merit of the object and consider only its economic value linked to its value as a broom.

works on the concept of value, both from economics and non-economics fields. In his essay, the author recognizes three main values a work of art can have: the economic value, the cultural value, and the artistic value, admitting the possibility of an overlap between the last two values. Velthuis (2007) identifies two approaches in literature to the distinction between the economic and the cultural value inside cultural goods' markets: the "hostile worlds" approach, which focuses on the idea that comparing art creation and diffusion with the logic of the market is detrimental for the artistic world, and the "nothing but" approach, for which the economic value can encompass the cultural value, that is, the two markets inside the art market (the one on artistic value and the one on the economic value) can be reduced to a single market. Velthuis's view, however, is that the two worlds cannot be divided and, in particular, that nowadays one cannot evaluate the artistic merit of an artwork without considering its economic value, which is a point of view that is the converse of what Van den Braembussche (1996, p. 33) points out, that is, that "[O]ne can value a work of art without being in a position to buy it". One of the recent works that reprises the issue on the relationship between the cultural and the economic value of an artistic good is the one by Hutter and Frey (2010), in which the authors propose that the cultural value has an effect on the economic value of the artistic goods, presenting examples to support their thesis; specifically, they analyze the effect of certain components of the cultural value on the price of the artworks, the best indicator for economic value (Throsby, 2001), recognizing implicitly a time effect on the dynamic of prices. In particular, also if the authors do not use the Throsby's classification explicitly, they refer to

the authenticity value in the Raffaello Sanzio's "Madonna of the Pinks" and Rembrandt's "Man in a Golden Helmet" cases,[9] and to the symbolic value together with a historical value in the Pollock's case.

Besides the classifications of value we presented above, also other classifications have been proposed in literature; in particular:

- vertical and horizontal qualities of a good (Ginsburgh and Weyers, 2008), the former being the ones of which every consumer prefers to have more than less, the latter being all the other qualities; this distinction can be called the Lancaster's view of the value;

- objective and subjective value (Throsby, 1990); in particular, Throsby distinguishes between characteristics of which a customer might make an objective scale, those that depend on subjective interpretation but whose consensus can be predicted among a majority of people, and those based on a subjective assessment and without a predictable consensus;

- collective and individualistic value (Throsby, 2001; Throsby and Zednik, 2014), that is, the cultural value an individual can recognize as benefiting the others (the former), and the one that comes from his interpretation that is effective from himself only (the latter);

- intrinsic and extrinsic value (Van den Braembussche, 1996; McCain, 2006); both the authors agree on the fact

[9] The importance of this value has been pointed out, later, also by Candela et al. (2009), analysing the case of ethnic art.

that the economic value is extrinsic, while the other values are intrinsic in the sense that they depend on individual preferences;

- static and dynamic value (Candela and Castellani, 2000); ideas as well as values can evolve overtime (the dynamic ones, as for example the historical value of an artwork) or can be stable (the static ones, as the classical beauty, which is part of aesthetic value).

The concept of dynamic value can be considered also as an explanation of how the value itself is formed, through a process of growth/decline which occurs thanks to the exchange and the interaction between the individuals of the population of a certain "society". Because of this, we can borrow Dekker (2014) words and call it "societal value", which is not the Throsby's social value; in fact, the idea behind this value is that there is some kind of value-, canon-, consensus-formation, in a process in which the exchange of points of view is key; in Klamer (2008) words, cultural goods are "discursive constructs" and their values are established through conversation. In other words, value is formed thanks to an institution which works through the action of social forces (Pretz, 2016). Although none of the considered authors defines it explicitly, several of them indirectly describe its development.[10] De Marchi (2008) goes further in delineate this process, stating that the exchange of points of view which is at the base of the formation of the cultural value is helped by the market.[11] In this dynamic of value formation

[10]See, for example, Bonus and Ronte (1997), Candela and Castellani (2000), Velthuis (2003), Candela and Scorcu (2004), McCain (2006), Hutter and Shusterman (2006), Hutter and Frey (2010), and Throsby and Zednik (2014).

[11]The "social production of art" has been deeply studied in sociology, with

through the market, an important role is played by the experts, the critics, the dealers, and, in general, every individual that may influence the non-informed collectors about some components of the cultural value they are not able to evaluate, as we will see later on in Subsection 3.2.2.

Despite of the attention given to the issue of cultural goods' value identification, none of these works considered explicitly the artist's characteristics as determinants of the economic value of an artwork; among these characteristics, fame and talent are those who may indeed have a role on influencing the economic value. Since the seminal works on talent and fame by Rosen (1981) and Adler (1985), the definition of artist's talent and fame is well-known by the cultural economists, although cultural economics literature lacks of an analytical definition of these characteristics.[12] While the artist's talent has be considered as an innate creative ability (Towse, 2006), the fame refers to the reputation concept and is related to the public information shared by the audience about the artist identity; the former is a static concept, since it cannot be modified in time neither by the artist nor by anyone else, while the latter is a typical dynamic concept, because it is influenced by the market reaction to everything that concerns the artist life. For example, the death of an artist has been found to affect her fame (Candela et al., 2016); at the same time, the artist's choice of appearing in a magazine could work as a signal of her popularity that could be perceived and processed by the audience and affect her rep-

focus on the importance of consensus on the value of the cultural characteristics, on the difficulty in conferring a value to a cultural good, and on the effect of markets on the creation of the cultural value; see, for example, Wolff (1981).

[12]Pretz (2016) proposes a critique of these two theories based on the fact that they ignore the social forces that stay behind the formation of superstardom. In other words, then, also fame is a societal value.

utation (Adler, 2006). However, this does not imply that talent cannot have different effects on cultural value in different time periods, since there could be a change in how society considers certain components of the cultural value; at the same time, fame can be influenced also by societal aspects not related to artist's life.

Our idea is that both these artist's characteristics influence positively the economic value: the fame directly affects it, through a brand effect (Schroeder, 2005; Zorloni, 2005; Muñiz Jr. et al., 2014), while the artist's talent, influencing the aesthetic value and the art-technical value (and thus the cultural value) with a series of stylistic choices, indirectly affects the economic value. Specifically, we assume that the artist's talent has no effect on the other components of cultural value, as well as fame has no effect at all on any of the cultural value components.

Figure 3.1 depicts the relationships between the artist-specific (the diamond-shaped nodes) and artwork-specific characteristics (the circle-shaped nodes), representing also the cultural value components (the rectangle-shaped nodes): the thick arrows represent the direction through which the influence of one of the measure goes (for example, artist's fame influences the artwork's economic value). Clearly, the figure does not contain all the artist's characteristics that could have an effect on the cultural and/or on the economic value, but it is limited to the two artist's characteristics considered to be the most important in cultural economic literature;[13] moreover, it represents a static mechanism of value formation.

[13]For example, if an artist studied in an art school, increasing her "crafting"/technical ability, her human capital could affect positively the art-technical value of her works (Towse, 2006).

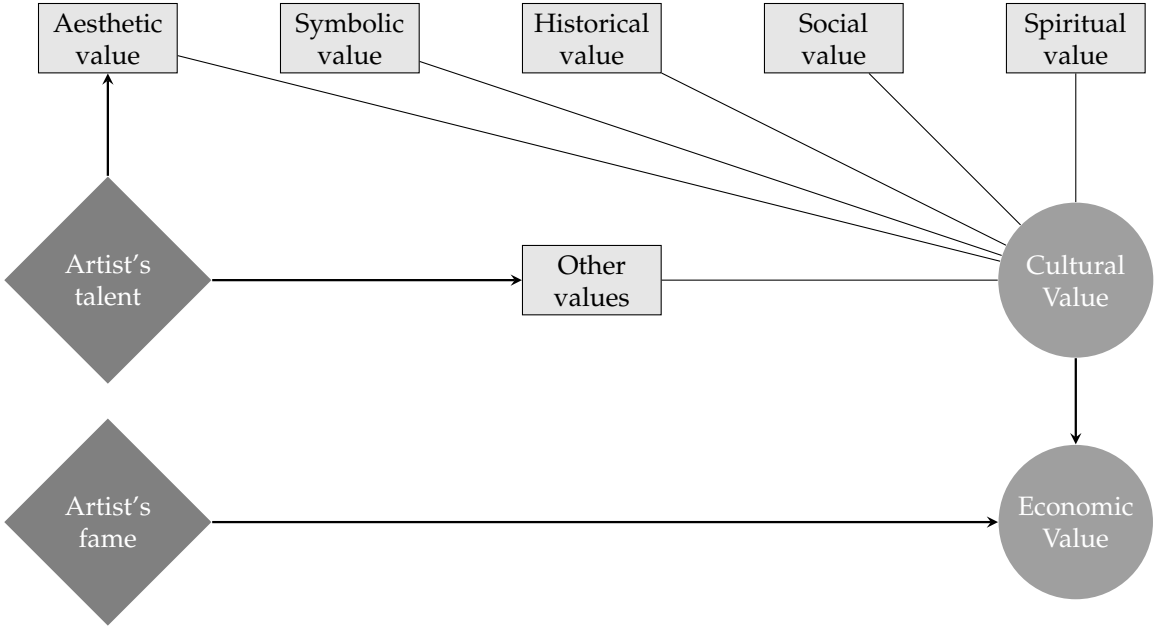


Figure 3.1: Artwork's values, artist's characteristics, and their relationships

3.2.2 On information in the art market

In order to emphasize the role of information in both the economics and in the cultural economics literature, in the following subsections we focus on the main works in these fields, and we present our contribution to the literature.

The role of information in the economics literature

Since Stigler (1961), the acknowledgment of the importance of information in economics has been increasing. Akerlof (1970) highlights that a situation of asymmetric information is a common problem in several markets, where the seller of a good can have more information about its quality than the buyer or *vice versa*, showing that this could produce adverse selection in these markets. Stigler (1961), Nelson (1970), and Darby and Karni (1973) identify three kinds of goods, depending on the level of information detained by the buyer, that is search, experience, and credence goods. A search good is a good for which the customer knows where to get information about and he only faces the problem linked to the fact that he has to choose among several options and to evaluate them before purchasing; for these goods the main characteristics, such as quality or price, are observable before consumption. An experience good is a good a customer has to buy in order to evaluate it, that is, the assessment of its quality needs the customer to experience the good; these goods' characteristics, such as quality, are not observable before purchasing, but can be ascertained upon consumption. Finally, a credence good is a good whose characteristics cannot be evaluate by the customer even after its use, and the assessment of its quality requires supplementary infor-

mation that could be costly to obtain; hence, consumers may require information from experts.

Signaling and screening has been proposed as possible solutions to asymmetric-information problems (adverse selection and moral hazard): Spence (1973) shows that more informed agents in markets with asymmetric information can have incentives to send costly and credible signal to less informed agents (signaling); Rothschild and Stiglitz (1976) show how less informed agents can obtain information from more informed agents by providing a set of alternative incentives, through which the informed ones can self-select for their characteristics (screening).

However, these solutions are well-suited only for experience goods, while for credence goods these strategies do not solve the asymmetric-information problem. For this reason, credence goods became a center of interest in literature, since Emons's works (Emons, 1997, 2001), who started a branch of literature that defined more precisely the issues related to this market and centered the attention in the characteristics of the agents that operate in a credence good's market that could avoid the appearance of these issues.[14] In particular, following Dulleck and Kerschbamer (2006, p. 7), credence goods' market is characterized by three specific problems, that is: undertreament, which occurs when the consumer requires a complex and expensive treatment but the expert provides a simple and inexpensive one; overtreatment, that occurs when the consumer requires an inexpensive and simple intervention, but the experts provides an expensive one, so that the consumer pays for an

[14]See, for example, Pesendorfer and Wolinsky (2003), Dulleck and Kerschbamer (2006), Dulleck and Kerschbamer (2009), Hyndman and Ozerturk (2011), Dulleck et al. (2011), and Dulleck et al. (2012).

additional benefit he does not need; overcharging, that occurs when the consumer receives exactly the treatment he needs, but pays for a more expensive treatment. As one can see, in all these three cases the consumer suffers from the expert's opportunistic behavior.[15] Dulleck and Kerschbamer (2006) and Dulleck et al. (2011) also identify the institutional and market conditions that can be observed in the credence goods markets; the institutional conditions are liability, that is, the expert must provide the expensive intervention when it is needed, and verifiability, that is, the impossibility for the expert to charge for the expensive treatment if he has provided the cheap one.[16] The market conditions, introduced by Dulleck et al. (2011), refer to the effect of the experts' reputation in customers' choices, that is, the non-anonymity of the experts, and to the competition in the market of the experts, that is, absence of bilateral monopoly (Dulleck et al., 2011, pp. 527-528). Table 1 in Dulleck et al. (2011, p. 533) presents all the possible combinations among institutional and market conditions, while Table 2 in Dulleck et al. (2011, p. 536) reports all the predictions of their model on trade and pricing.

[15]Dulleck and Kerschbamer (2006) also highlight two other issues that could emerge in the credence goods' market, that is, price discrimination, and the search cost a customer could incur in when he visits more experts in order to obtain a diagnosis for the quality he needs.

[16]The authors also identify two additional characteristics of the customers that can influence the effect of the asymmetric information; these are the commitment, that is, the customer must undergo the intervention the expert recommended him, and the homogeneity, that is, the fact that the customers of the market have the same information set (Dulleck and Kerschbamer, 2006, p. 12).

The role of information in cultural economics

One of the first cultural economics contribution on the role of information in the cultural markets is the chapter by McCain (1980), in which the author highlights the presence of an information-based market failure in the art market, due to the "lemon" character of what he calls "pattern-complex" goods, that is, artistic goods which are difficult to interpret and understand by people who have not enough knowledge of the art. Later, Bonus and Ronte (1997, p. 104) claim that cultural goods do not fall neither in the search goods' category, nor in the experience goods' category, nor in the credence goods' one, and at the same time define the "cultural quality" as the fourth category of goods, which can be evaluated only thanks to "[a] highly specific type of cultural knowledge" and through "a process of generating credibility, a process in which experts from the art scene have a key role"; Caves (2003, p. 75) asserts that "in creative industries *nobody knows*, and the core problem is one of symmetrical ignorance"; Blaug (2001, p. 125) states that cultural goods are "typically experience goods for which tastes have to be acquired by a temporal process of consumption"; Zorloni (2013, p. 51) identifies the artworks sold in the contemporary art market as "trust good, whose quality is not assessable by the buyer neither before nor after purchase due to lack of technical and cultural knowledge", with a definition which is very similar to the credence goods' one.[17] Finally, Candela et al. (2012) empirically investigate the role of signaling in tribal art market.

[17] Lupton (2005) introduces the concept of indeterminate good, as a commodity whose quality is uncertain for everyone, using as an example the artistic good, though she points out that the artist alone knows the quality in this case.

As in the market for professional services, the experts are the most informed agents among those that operate in the art market. Their importance has been analyzed primarily by Cameron (1995), who highlights their role in spreading the information about the artworks, as well as other functions, among which their contribution to the formation of artists' reputation; Velthuis (2012) stresses the importance of the experts in determining the "artist's commercial credibility"; Wijnberg and Gemser (2000) state that the artists' selection system in the art market evolved from a system based on market and peer selection to a system where experts selection became more important; Ginsburgh (2003) points out that experts' function in the contemporary art market is to help the collectors to evaluate the artworks' quality; Ginsburgh and van Ours (2003) study the effect of experts evaluation in the success of the artists who participated to a musical competition; Khaire (2015) defines "intermediaries" those individuals who mediate between the consumer and the producer/seller, increasing the information provided by the latter. Moreover, experts act as gatekeepers in the art market, as pointed out by Candela and Scorcu (2004), and may have an influence on the perception of artworks' quality, as empirically tested by Reinstein and Snyder (2005).[18]

Our contribution to the literature

In order to conceptualize the information problem in the art market, we propose the existence of four levels of information availability, depending on the type of agent that operates in the

[18] As Wijnberg (1995) points out, "[t]he experts function as 'certifiers' [...] determining at the same time whether an object is a work of [...] art and its quality" (p. 229).

market; starting from the most informed agent, we have:

1. the artist, who knows all the characteristics of the artwork she created, clearly;

2. the art dealers as the galleries, for whom the art good is a search good, since they face the various options of purchase among various artists' artworks and they incur in negligible costs to inspect the artworks before they buy one or more of them;

3. the sophisticated collectors, the "insiders" (see Chapter 2 and Bonus and Ronte (1997)), who detain the ability to quantify the value of an artwork, but only after the purchase, since they imperfectly observe the quality/talent signals and realize the artworks' real value; hence, the artworks are experience goods for these agents;

4. the unsophisticated collectors, the "outsiders" (see Chapter 2 and Bonus and Ronte (1997)), for which artworks are nothing more than credence goods.

We can now introduce two new measures in the framework depicted in Subsection 3.2.1 (see Figure 3.1), in order to better define the information problem: the price, which can be observed by everyone that takes part to the transaction and that is generated from the economic value; the quality, which can be observed before the trade only by the dealers and the artist, and after the trade by the insider collectors, while it can never be observed by the outsiders; it is generated by the cultural value and influences the economic value. Figure 3.2 integrates the framework represented in Figure 3.1 by adding these new measures and their links with the already

defined variables; in this representation, we omitted the components of the cultural value in order to highlight the relationships between the artist-specific characteristics (the diamond-shaped nodes), the artwork-specific and latent characteristics (the circle-shaped nodes), and the just-introduced artwork-specific and partially observable characteristics (the ellipse-shaped nodes); the dashed arrow represents an indirect effect, while the thick one represents a direct one.

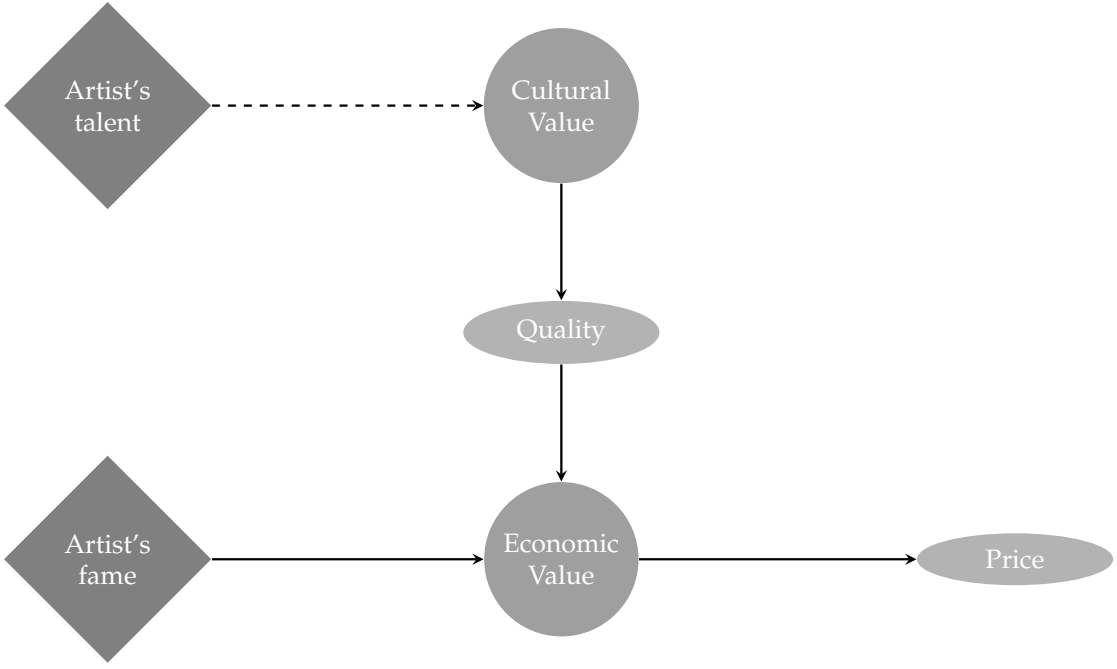


Figure 3.2: Artwork's values and characteristics, artist's characteristics, and their relationships

In particular, we assume that the insider collectors know *ex-ante* the artist's fame and *ex-post* the artist's talent, and hence the artwork's cultural value and quality, while the outsider collectors only know the artist's fame *ex-ante*, but they can never observe her talent (nor her artwork's cultural value and quality). Both collectors form their expectations on the artwork's quality observing *ex-ante* the artist's fame, but only the insider collectors can observe *ex-post* the actual quality and economic value of the artwork, understanding if his expectations on quality were correct; if the insider discovers to have formed wrong expectations on an artwork, over-evaluating its quality, he will then suffer disappointment.[19] Conversely, the outsider collectors is not able to check the actual quality of the artwork without the help of an expert, being the artwork a credence good for them.

In our framework, the experts can be classified in three types: galleries and dealers, who sell the artworks; sophisticated collectors (what we called insiders), who buy the artworks; critics, who may also be dealers or collectors. We claim that the dealers, who are also critics, are the only agents who provide information to the outsiders and, hence, influence directly their perception of quality. Their expertise, recognized in the market, is formed through a reputation-building mechanism, which may be based on a network system (Bonus and Ronte, 1997) or on a "market of critics" (Cameron, 1995).[20]

[19]The behavioral economics model of disappointment (and elation) has been introduced by Bell (1985); Bell defines disappointment as "a psychological reaction to an outcome that does not match up to expectations. The greater the disparity, the greater the disappointment", while he defines elation as "the euphoria associated with an outcome that exceeds expectations" (p. 1). For a generalization of Bell's model, see Loomes and Sugden (1986). See Spiegler (2011) for a recent overview on irrational consumers' behaviours.

[20]Greenfeld (1988) affirms that the reputation of a critic depends on the social context in which his reviews are considered, using an example of the Israeli

Following Dulleck et al. (2011) classification, then, the institutional configuration of art market's credence goods is no liability/no verifiability, which interacts with one of the four possible market conditions in Table 2 of Dulleck et al. (2011, p. 536). The most likely combination between institutional and market conditions in art market is no liability/no verifiability together with competition/reputation.[21] In fact, the outsiders have no information on the quality of the art good besides the artists' reputation, hence they see all the artworks made by artists with the same level of fame as perfect substitutes until the dealer does not reveal or does not signal the artworks' quality. For this reason undertreatment and overcharging could potentially emerge in the credence good market. In particular, given the impossibility for the outsider to check for the actual quality, he will trust the expert; on the other hand, given the absence of commitment in this market, the gallery may propose a low-quality artwork, describing it as a high-quality one and, then, selling it as if it is a high-quality one. If, instead, the gallery suggests to the outsider a certain artwork, revealing its real quality, but make him pay a higher price than the fair one, we would incur in overcharging. As we will see, this second case is not what occurs in the art market because of the existence of discounting, as well as the fact that in this market the uninformed agents do not know the quality but are able to correctly form reserve prices.

In order to shed light on the role of value and information in the formation of quality and price in the art market, we extend the

avant-garde versus traditional art markets; her example is coherent with both these two proposed reputation-formation mechanisms.

[21] With "competition" term we intend that informed agents compete on providing the expertise and not on selling the artwork.

price-formation model that we depicted in Chapter 2, briefly recalled in the Section 3.3; in doing so, we explicitly adopt a behavioral economics approach to explain the price distortions generated both by the disappointment issue and by the credence good status of the art goods.

3.3 The full-information model

In this section we present a summary of the model we developed in Chapter 2, which analyses how an artwork created by an artist and never exchanged before in the market can take different paths to reach a collector or an auction house, that is, how the private art market works and how the market power of each of the agents that operates in it affects the price formation. This is done assuming that all the agents except the unsophisticated collectors have perfect information, and that all the agents can form rational expectations. In the model, there are only two types of trade mechanisms, auction (A) or bargaining (B), and five types of agents: the auction house (h), the artist (a, "she"), the gallery (g), and two types of collectors, the insider collector (i), and the outsider collector (o). In this framework, the auctioneer intermediates trades between the seller (s) and the bidders/buyers (b), the artist makes artworks which can be sold in the art market through auctions or via bargaining with the gallery and/or with the insider, the gallery and the insider buy and sell the artwork, while the outsider can only buy the artwork (final buyer). From the combination of all potential bargaining and auctions, nine supply and demand channels arise: artist–auction house (ah) in the primary market; artist–insider–auction house (aih), artist–gallery–

auction house (agh), and artist–gallery–outsider (ago) in the primary and in the secondary market; artist–insider–gallery–auction house ($aigh$), and artist–insider–gallery–outsider ($aigo$) in the primary, the secondary and the tertiary market. Then, there exist six sales channels available to agents with three double bargaining, two triple bargaining and one single bargaining. Figure 3.3 graphically shows all the bilateral bargaining the five agents can carry through in each market and in every channel.

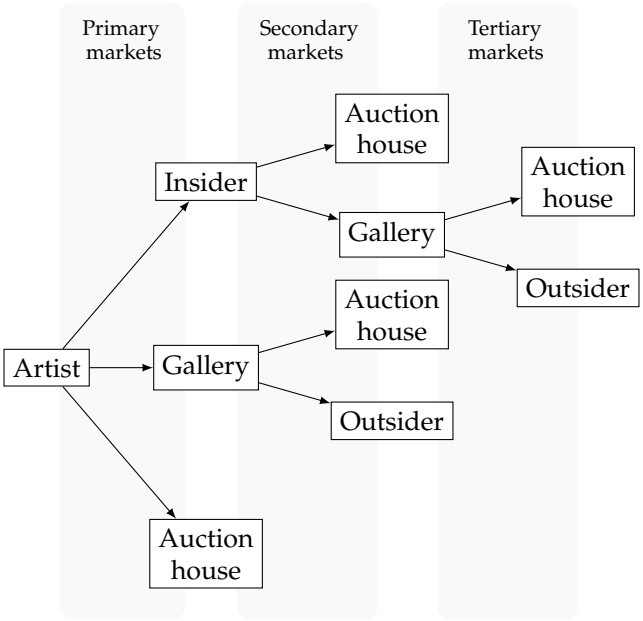


Figure 3.3: Potential bargaining in the full-information model from Chapter 2

Given as exogenous variables the reserve prices of the agents P_R^a, P_R^b, and P_R^o (for artist's, bidder's, and outsider's reserve price, respectively), the price guaranteed by the auctioneer P_A and the price posted by the gallery P_G, the model simultaneously determines, through a multiple Nash-bargaining game, a series of bargaining prices, as P_{Bz}^y, where $y = ai, ag, ah, ih, ig, gh, go$ indicates the pair of agents participating in the bargaining and $z = ah, aih, ago, aigh, aigo$ denotes the channel where the trade takes place. In particular, assuming that the seller's bargaining power (market power), that lays between 0 and 1, is the complement to one of the buyer's bargaining power (buying power), in Chapter 2 we defined $0 < \xi_y < 1$ and $0 < 1 - \xi_y < 1$, as a measure of the relative market and buyer power of every agent over each other for each bargaining game y.[22] In each bargaining game, the general problem that the seller has to solve is:[23]

$$\max_{P_z^y} \left[(P_z^y - P_s^y)^{\xi_y} (P_b^y - P_z^y)^{1-\xi_y} \right] \tag{3.1}$$

given that

$$P_s^y < P_z^y < P_b^y \tag{3.2}$$

which is solved for

$$P_z^y = (1 - \xi_y) P_s^y + \xi_y P_b^y \tag{3.3}$$

The price generated through each bargaining depends on both

[22] In particular, $\xi_{ai} = \alpha$ is the artist's market power when facing the insider, $\xi_{ag} = \beta$ is her market power when facing the gallery, $\xi_{ah} = \eta$ is her market power when facing the auction house, $\xi_{ih} = \mu$ is the insider's market power when facing the auction house, $\xi_{ig} = \gamma$ is his market power when facing the gallery, $\xi_{go} = \delta$ is the gallery's market power when facing the outsider, and $\xi_{gh} = \nu$ is its market power when facing the auction house.

[23] From now on, we drop the B from P_{Bz}^y in order to simplify the notation.

the bargaining power of the agents involved in each transaction y, and by the channel z where every transaction occurs. In Table 3.2, we report all the bargaining prices calculated in Chapter 2. Given other assumptions on prices that we do not report in this paper, starting from these bargaining prices and through a backward induction procedure, we found the necessary and sufficient conditions for each agent's choice in every market. In particular, in Table 3.3 we only report the conditions for the emergence of the $aigo$ and ago paths, the two channels in which we will focus since the outsiders appear only in them and, hence, the information issue is more likely to be observed. In fact, to take into account the issues presented in Section 3.2, we need to modify the model in Chapter 2 explicitly introducing both the role of information and the artist's fame and talent effects on the artworks' price formation.

3.4 The "insider-outsider" model

Starting from the Figure 3.1 which depicts the relationship between the artist's fame and talent and artwork's cultural and economic value, we can imagine that the artist m plays a game against the Nature, where the Nature first chooses the artist's talent and then the artist's fame: $\theta_{j,m}$, with $j \in \{H, L\}$, is the artist's talent, that can be high (H) or low (L), and $\phi_{k,m}$, with $k \in \{H, L\}$, is the artist's fame, which can be high (H) or low (L), so that $\phi_{H,m} > \phi_{L,m}$ and $\theta_{H,m} > \theta_{L,m}$. As for the results we present in Chapter 4, in fact, these two artists' characteristics have a bimodal distribution. Let $0 \leq \rho \leq 1$ denote the probability of having a high talented artist's artwork and $0 \leq 1 - \rho \leq 1$ define the probability of having a low-talented

Table 3.2: Bargaining prices

Agents	Paths	Prices
ai	aih	$P^{ai}_{aih} = (1-\alpha)P^{a}_{R} + \alpha P^{ih}_{aih}$
	$aigh$	$P^{ai}_{aigh} = (1-\alpha)P^{a}_{R} + \alpha P^{ig}_{aigh}$
	$aigo$	$P^{ai}_{aigo} = (1-\alpha)P^{a}_{R} + \alpha P^{ig}_{aigo}$
ag	agh	$P^{ag}_{agh} = (1-\beta)P^{a}_{R} + \beta P^{gh}_{agh}$
	ago	$P^{ag}_{ago} = (1-\beta)P^{a}_{R} + \beta P^{go}_{ago}$
ah	ah	$P^{ah}_{ah} = (1-\eta)P^{a}_{R} + \eta P^{o}_{R}$
ih	aih	$P^{ih}_{aih} = (1-\mu)P^{ai}_{aih} + \mu P^{o}_{R}$
ig	$aigh$	$P^{ig}_{aigh} = (1-\gamma)P^{ai}_{aigh} + \gamma P^{gh}_{aigh}$
	$aigo$	$P^{ig}_{aigo} = (1-\gamma)P^{ai}_{aigo} + \gamma P^{go}_{aigo}$
gh	agh	$P^{gh}_{agh} = (1-\nu)P^{ag}_{agh} + \nu P^{o}_{R}$
	$aigh$	$P^{gh}_{aigh} = (1-\nu)P^{ig}_{aigh} + \nu P^{o}_{R}$
go	ago	$P^{go}_{ago} = (1-\delta)P^{ag}_{ago} + \delta P^{o}_{R}$
	$aigo$	$P^{go}_{aigo} = (1-\delta)P^{ig}_{aigo} + \delta P^{o}_{R}$

Table 3.3: Conditions from the model in Chapter 2 for the paths $aigo$ and ago

Paths	*iff*
$aigo$	$\nu < \delta \wedge \mu < \frac{\delta\gamma}{1-\gamma(1-\delta)} \wedge \eta < \frac{\alpha\gamma\delta}{1-\alpha(1-\gamma)-\gamma(1-\delta)} \wedge \beta < \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\delta))-\gamma(1-\delta)}$
ago	$\nu < \delta \wedge \eta < \frac{\beta\delta}{1-\beta(1-\delta)} \wedge \begin{array}{l} \mu < \frac{\delta\gamma}{1-\gamma(1-\delta)} \wedge \beta > \frac{\alpha\gamma}{1-\alpha(1-\gamma(2-\delta))-\gamma(1-\delta)} \\ \mu > \frac{\delta\gamma}{1-\gamma(1-\delta)} \wedge \beta > \frac{\alpha\mu}{\alpha\mu+\delta(1-\alpha)} \end{array}$

artist's one, while $0 \leq \tau \leq 1$ is the probability of having a high-famed artist's artwork and $0 \leq 1-\tau \leq 1$ is the probability of having low-famed artist's one. In Figure 3.4, we depict the game between the artist and the Nature.

After the Nature's move, the artist m creates the artwork n, whose quality $q_{m,n}$ will depend on the cultural value compo-

nents influenced by the artist's talent, and on its other components (Ω_n), independent on the artist's characteristics. Hence, the technology that produces the artwork's quality is:

$$q_{m,n} = F(\theta_{j,m}, \Omega_n) \tag{3.4}$$

We assume that $F(\cdot)$ is increasing in its arguments. While the artist perfectly knows $F(\cdot)$, $\theta_{j,m}$, and Ω_n, as well as the gallery does, the insider only knows Ω_n and $\theta_{j,m}$ after purchasing, while the outsider will never know $q_{m,n}$ without external help. Hereafter we will drop both the m and n subscripts, since we will focus on a single artwork of a single artist at a time.
Given that our model is static, Ω is not likely to change since its components tend to change slowly overtime, and hence it can be taken as fixed; this implies that a higher talent will correspond to a higher quality and, in particular, that we can refer either to the artist's talent or to that artist artwork's quality without generating confusion.
After she creates the artwork, the artist can choose to sell it either to the gallery or to the insider; in particular, we focus only on two paths among those we presented in the Section 3.3, that is, ago and $aigo$ paths, since the outsider appears at the end of each of them and, hence, the information-related issues we are interested in are more likely to be observed. In the ago path, the artist bargains the price of her artwork with the gallery, who sells it to the outsider, while in the $aigo$ path the artist sells her artwork to the insider, who could resell it to the gallery, that will then resell it to the outsider.

Observing the artist's talent and fame, galleries know the features and characteristics of an artwork before purchasing it (search good), while insider collectors can ascertain artwork

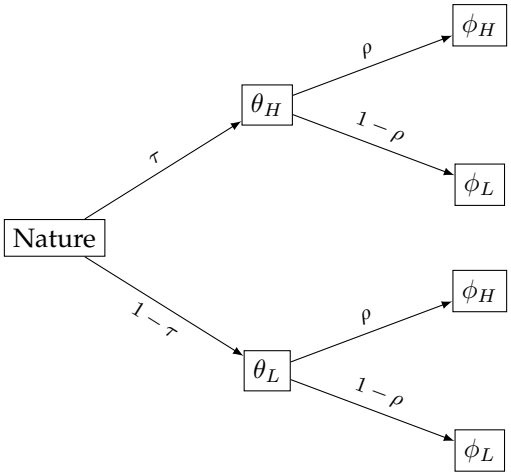


Figure 3.4: The Nature game

characteristics after purchasing, not knowing the artist's talent in advance (experience good). Outsider collectors can never ascertain the quality of an artwork by themselves (credence good), but their knowledge of the artist's fame, together with the experts' advices given by the critics (dealers or galleries in our framework), let them form a reserve price. Therefore, the agents' reserve prices and posted prices all depend on the unobservable or partially observable talent and on the fame of artists. We also assume that all the price functions are weakly increasing in their arguments.

Given these assumptions, we analyse in-depth the price formation mechanism in both the ago and the $aigo$ path, focusing on how the agents behave depending on the level of information asymmetry. In particular, we first analyze the case of the art good as credence good (Subsection 3.4.1), then as experi-

ence good (Subsection 3.4.2), and finally we analyse the case of full information when the art good is a search good for the gallery and when the insider has already bought the artwork (Subsection 3.4.3).

3.4.1 Art as a credence good

In our framework, cultural goods configure as a credence good for the outsider when he interacts with the gallery, that is, at the end of both the ago and the $aigo$ path. Since the outsider completely lacks of information on the good's quality, the gallery, which is full informed, can take advantage of this information asymmetry.
In these trades, gallery can post a price $P^g(\theta_j, \phi_k)$ that embodies the information on artist's talent that the gallery wants to signal to the outsiders, that is, its expertise, since the artwork is a credence good for these collectors. The gallery strategy about posted prices depends on the combination between fame and talent levels of the artist who created the artwork. In particular, when both talent and fame are high, the gallery will post a price equal to $P^g(\theta_H, \phi_H) \equiv P^g_{HH}$, which reflects the actual quality of the artwork. If talent is low and fame is high, the gallery's choice will be again the same posted price P^g_{HH} (undertreatment), since the outsider cannot check for the artist's talent and he will trust the gallery's expertise and buy the artwork. When talent is high and fame is low, the gallery will post a price equal to $P^g(\theta_H, \phi_L) \equiv P^g_{HL}$, assuming the power of persuasion of the gallery is strong and hence the outsider will trust its expertise and buy the artwork; moreover, we assume that $P^g_{HL} < P^g_{HH}$, since the outsider uses the fame as a signal of quality (Beckert and Rössel, 2013) and the gallery knows that.

Finally, when both fame and talent are low, the gallery will post a price equal to P^g_{HL} (undertreatment), since it can persuade the outsider about the quality of the artwork letting him think that it is high even if it is low.[24] In other words, the gallery influences the outsider first letting him think that the artwork he faces is a high-quality one, and then selling him an artwork at a high-quality price even if it is not.

The outsider uses both the artist's fame and the artwork's posted price to form his reserve price, so that $R^o(P^g_l, \phi_k)$ is the outsider's reserve price, where $l \in \{HL, HH\}$. Since the gallery may post two different price levels ($P^g_{HL} < P^g_{HH}$), the outsider, combining the expertise signal with the fame signal, ends up to have two possible reserve prices: $R^o(P^g_{HH}, \phi_H) \equiv R^o_H > R^o_L \equiv R^o(P^g_{HL}, \phi_L)$.

Given that the gallery knows what the outsider's reserve price is, as well as that he wants some kind of discount on the price (haggling, the most common commercial practice in the art market) since it is a habit in the art market, it will post a price which is bigger than the outsider's reserve price, and it will allow for a discount, so that it will gain exactly the outsider's reserve price; in fact, as suggested by Velthuis (2007), the gallery's posted price is likely higher than the bidders' reserve price. Formally, the discounts are equal to $P^g_{HH} - R^o_H = D_H > 0$ and to $P^g_{HL} - R^o_L = D_L > 0$. In this way, the outsider will buy the artwork in both high- and low-fame cases, and the gallery will always receive the outsider's reserve price.

[24] For this reason, the gallery will never post P^g_{LH} and P^g_{LL}, that is, respectively, the posted price for a low-talented and high-famed artist's artwork and the posted price for a low-talented and low-famed one that would have been posted in case of full information, since in the current framework these two strategies are strictly dominated.

Claim 3.1 *In the secondary and tertiary market, the outsider, for which art is a credence good, will suffer undertreatment only when artist's talent is low.*

3.4.2 Art as an experience good

When the insider and the artist interact in order to exchange an artwork, at the beginning of the $aigo$ path, the latter has private information on her artwork's quality which is not known by the the former. In fact, the insider knows the artist's fame before purchasing and her talent only after purchasing the artwork, so he forms an expectation on the artist's talent based on his private information and on artist's fame; assuming the insider is risk-neutral, and then $E[\theta] = \rho\theta_H + (1-\rho)\theta_L \equiv \hat{\theta}$, his reserve price $\hat{R}^i(\hat{\theta}, \phi_k)$ can take two levels: $\hat{R}^i(\hat{\theta}, \phi_H) \equiv R^i_H > R^i_L \equiv \hat{R}^i(\hat{\theta}, \phi_L)$.[25]

On the other hand, the artist knows both her talent and her fame after she played against the Nature, and then she forms her reserve price $R^a(\theta_j, \phi_k)$, where:

$$\begin{aligned} &R^a(\theta_H, \phi_H) \equiv R^a_{HH} > R^a(\theta_H, \phi_L) \equiv R^a_{HL} > R^a(\theta_L, \phi_H) \equiv \\ &\equiv R^a_{LH} > R^a(\theta_L, \phi_L) \equiv R^a_{LL} \end{aligned} \tag{3.5}$$

Notice that we are assuming that the artist has lexicographic preferences on quality and fame, which are defined before the Nature plays: she first prefers high quality to low quality, and then high fame to low fame, that is, an increase in the fame level does not compensate a decrease in the talent level.[26] The artist

[25] Since $\hat{R}(\cdot)$ is increasing in its arguments, we will have that $\hat{R}^i(\theta_L, \phi_H) < R^i_H < \hat{R}^i(\theta_H, \phi_H)$ and that $\hat{R}^i(\theta_L, \phi_L) < R^i_L < \hat{R}^i(\theta_H, \phi_L)$.

[26] This assumption is equivalent to have an artist's utility function defined on both fame and talent, with increasing first derivatives, in which the marginal

may also post a price $P^a(\theta_j, \phi_k)$, where $P^a(\theta_H, \phi_H) \equiv P^a_{HH} > P^a(\theta_H, \phi_L) \equiv P^a_{HL} > P^a(\theta_L, \phi_H) \equiv P^a_{LH} > P^a(\theta_L, \phi_L) \equiv P^a_{LL}$. We assume that $R^a_{HH} \leq P^a_{HH}$, $R^a_{HL} \leq P^a_{HL}$, $R^a_{LH} \leq P^a_{LH}$, and $R^a_{LL} \leq P^a_{LL}$, that is, artists' posted prices are never smaller than their reserve prices.

When the artist sells the artwork to the insider, the combination between the actual couple talent-fame and insider's expected talent together with the actual fame will lead to different outcomes. We also assume that the artist knows the insider's reserve prices, but the insider does not know the artist's ones.[27] If both talent and fame are high, and so the insider knows that fame is high, the artist will post a price equal to P^a_{HH} which we assume to be higher than the insider's high reserve price R^i_H, and hence the artist will prefer not to sell to the insider in this case. A similar case arises when talent is high and fame is low, since the artist will post a price P^a_{HL} which, for a similar reasoning, will be higher than the insider's low reserve price R^i_L, and again high talent is washed out from the market. Notice that these two cases configure as the standard Akerlof's lemon problem, in which high talent is washed out from the market, even if there exists a signal of the quality. Instead, when talent and fame are both low, the artist will post a price P^a_{LL} which will be equal to the reserve price of the insider R^i_L, while when talent is low and fame is high, the artist will post a price P^a_{LH}, that will be equal to the insider's reserve price R^i_H. In both these last cases, however, the insider will discover after the pur-

substitution rate between fame and talent is smaller than 1. We assume that also galleries follows a similar lexicographic ordering of their preferences.

[27] Note that the insider does not know neither the artist's low-quality reserve price, nor her high-quality reserve price; this uncertainty permits to avoid that low-quality artworks drive high-quality ones from the market.

chase that the actual quality of the artwork is lower than the expected one, and hence will suffer disappointment. Using the notation in Bell (1985), the purchase of the artwork made by the insider can be seen as a lottery, in which there is a certain probability (ρ) that the artwork will have a high quality and then a value equal to $\hat{R}^i(\theta_H, \phi_k)$, and a probability equal to $1-\rho$ that the artwork will have a value equal to $\hat{R}^i(\theta_L, \phi_k) < \hat{R}^i(\theta_H, \phi_k)$. This implies that, if the lottery pays $\hat{R}^i(\theta_L, \phi_k)$, the insider will suffer a disappointment $\hat{\delta}$ equal to:

$$\begin{aligned}\hat{\delta}_k &= \delta\left[\rho\hat{R}^i(\theta_H,\phi_k) + (1-\rho)\hat{R}^i(\theta_L,\phi_k) - \hat{R}^i(\theta_L,\phi_k)\right] = \\ &= \delta\rho\left[\hat{R}^i(\theta_H,\phi_k) - \hat{R}^i(\theta_L,\phi_k)\right] \geq 0\end{aligned} \tag{3.6}$$

where $k \in \{L, H\}$, and $\delta \geq 0$ is the disappointment parameter.[28]

We crucially assume that, in case the insider suffers disappointment, he will resell the artwork to the gallery through a bargaining mechanism.

[28] If, instead, the insider will find that the actual quality is high, he will experience an elation ($\hat{\varepsilon}$) equal to:

$$\begin{aligned}\hat{\varepsilon}_k &= \varepsilon\left[\hat{R}^i(\theta_H,\phi_k) - \rho\hat{R}^i(\theta_H,\phi_k) - (1-\rho)\hat{R}^i(\theta_L,\phi_k)\right] = \\ &= \varepsilon(1-\rho)\left[\hat{R}^i(\theta_H,\phi_k) - \hat{R}^i(\theta_L,\phi_k)\right] \geq 0\end{aligned}$$

where $k \in \{L, H\}$, $\varepsilon \geq 0$ is the elation parameter. Notice that we could allow all the agents in the market to potentially suffer disappointment or enjoy elation, but we need a certain level of information availability to let these situations occur, that is, we can potentially observe disappointment or elation only in the case in which the quality is not observable *ex-ante* but it is *ex-post*. Also, disappointment (and elation) is likely to occur only if the price paid is high enough, that is, an agent will less likely suffer disappointment (enjoy elation) if he pays a low price, so we hereafter assume that the price paid is enough high to let the potential occurrence of disappointment (elation).

Claim 3.2 *In the primary market, the insider, for which art is an experience good, will always suffer disappointment.*

3.4.3 Art as a search good

As we show in the model in Chapter 2, in case the agents are full-informed, the cultural goods can be seen as a search good. Focusing on the $aigo$ and ago channels, a bargaining occurs between the insider and the gallery in the $aigo$ path, and between the artist and the gallery in the ago path. Notice that in both the trade between the gallery and the outsider and the one between the artist and the insider we saw in previous subsections there is not a proper bargaining process at work, given the asymmetry in the information among the two agents in each exchange. As we said, the outsider will always have a lack of information, even after the purchase, while the insider only has an expectation on θ when facing the artist. Conversely, after the purchase, he has full information on the artwork he bought and, in the case he suffers disappointment, he will resell the artwork to the gallery. In this situation in which both agents are full-informed, they can negotiate on the final price through a bargaining based on their market powers. In particular, since the insider will resell only in case the artist's talent is low, and since the gallery has its own reserve price $R^g_{jk} \equiv R^g(\theta_j, \phi_k)$, where $R^g(\theta_j, \phi_k) \equiv R^g_{jk}$ and $R^a_{HH} > R^a_{HL} > R^a_{LH} > R^a_{LL}$,[29] we can have two possible couples of prices that define the interval over which the bargaining is done, that is: $\hat{R}^i(\theta_L, \phi_L)$ and R^g_{LL}, and $\hat{R}^i(\theta_L, \phi_H)$ and R^g_{LH}. Assuming $\hat{R}^i(\theta_L, \phi_L) \leq R^g_{LL}$, and $\hat{R}^i(\theta_L, \phi_H) \leq R^g_{LH}$, the solutions of the two bargaining

[29] Notice that, as for the artist's, the gallery's reserve prices follow a lexicographic ordering.

problems are obtained from Table 3.2 by substituting in $P^{ig}_{aigo} = (1-\gamma)P^{ai}_{aigo} + \gamma P^{go}_{aigo}$, either $\hat{R}^i(\theta_L, \phi_L)$ or $\hat{R}^i(\theta_L, \phi_H)$ to P^{ai}_{aigo} and, respectively, either R^g_{LL} or R^g_{LH} to P^{go}_{aigo}.
For what concerns the ag trade, we assume that $P^a_{jk} < R^g_{jk}$ where $j, k \in \{H, L\}$, and, as for the artist, ; we also assume that the gallery's posted prices are such that $R^g_{HH} \leq P^g_{HH}$, $R^g_{HL} \leq P^g_{HL}$, $R^g_{LH} \leq P^g_{LH}$, and $R^g_{LL} \leq P^g_{LL}$; hence, we have that the bargaining price belongs to the interval $(P^a_{jk}, R^g_{jk})\ \forall j, k$. Given what we have in Table 3.2, the solution of the bargaining problem in this trade will be $P^{ag}_{ago}(\theta_j, \phi_k) = (1-\beta)P^a_{jk} + \beta R^g_{jk}$.

Claim 3.3 *When there are no search costs for the gallery, the primary market that involves the galleries and the artists will behave in the same way as in the full-information model. Similarly, if the insider will resell the artwork he bought, he will bargain the price with the gallery as in the full-information model.*

3.5 Discussion

In Figure 3.5 we present the structure of the game in the ago path. As one can see, all the combinations between artist's fame and talent are potentially observable in this path. At the end of the path, the outsider's payoff will be always equal to 0, since the gallery will play strategically always posting a price in line with the fame signal. The relationship between Π^a_{HL} and Π^a_{LL} depends on the market power of the artist (β), on the difference between R^a_{HL} and R^a_{LL} and between R^g_{HL} and R^g_{LL}, and on the gap between P^a_{HL} and P^a_{LL}, so that:

$$\begin{aligned} &\Pi^a_{LL} > \Pi^a_{HL} \iff \\ &(1-\beta)\left[(P^a_{HL} - P^a_{LL})\right] < R^a_{HL} - R^a_{LL} - \beta(R^g_{HL} - R^g_{LL}) \end{aligned} \tag{3.7}$$

Similarly, the relationship between Π^a_{HH} and Π^a_{LH} depends on β, on the difference between R^a_{HH} and R^a_{LH}, on the one between R^g_{HH} and R^g_{LH}, and on the one between P^a_{HH} and P^a_{LH}:

$$\begin{aligned} &\Pi^a_{LH} > \Pi^a_{HH} \iff \\ &(1-\beta)\left[(P^a_{HH} - P^a_{LH})\right] < R^a_{HH} - R^a_{LH} - \beta(R^g_{HH} - R^g_{LH}) \end{aligned} \tag{3.8}$$

Galleries in the ago path will be able to capture all the outsider's reserve price, which depends on fame. Given a certain level of fame, do they gain more in selling a high-quality artwork or a low-quality one? We first analyze the high-talented artist' case; low-quality is more profitable for the gallery if $\Pi^g_{HH} < \Pi^g_{LH}$, that is:

$$(1-\beta)(P^a_{HH} - P^a_{LH}) > \beta(R^g_{LH} - R^g_{HH}) \tag{3.9}$$

since $P^a_{HH} - P^a_{LH} > 0$, while $R^g_{LH} - R^g_{HH} < 0$, the condition in (3.9) is always respected. It is easy to proof that the same reasoning holds for low-talented artists. In fact, $\Pi^g_{HL} < \Pi^g_{LL}$ is always true; we can rewrite it as:

$$(1-\beta)(P^a_{HL} - P^a_{LL}) > \beta(R^g_{LL} - R^g_{HL}) \tag{3.10}$$

Since $P^a_{HL} - P^a_{LL} > 0$ while $R^g_{LL} - R^g_{HL} < 0$, the condition in (3.10) always holds as well.

This is intuitive, since the gallery can exploit the asymmetry in information with the outsider, but when it faces the artist the price is determined through a pure Nash-bargaining. In other words, *ceteris paribus*, the gallery will gain less in a situation of high-talented artist than in a situation of low-talented one, since the price it will post is independent on talent, while artist gives a higher value to one of her artwork which incorporates

a higher talent and, hence, a higher quality. However, high quality is not driven from the market, since the galleries gain a positive payoff also selling a high-talented artist's artwork.
Figure 3.6 contains the only observable transactions of an artwork in the $aigo$ path, that is, when it has been made by a low-talented artist. As in the ago path, the outsider will always have a null payoff; however, this time the ordering between the gallery's payoffs Π^g_{LH} and Π^g_{LL} depends on the gap between the gallery's reserve prices R^g_{LH} and R^g_{LL}, on the one between the outsider's reserve prices R^o_L and R^o_H, and on the gap between the two insider's reserve prices $\hat{R}^i(\theta_L, \phi_H)$ and $\hat{R}^i(\theta_L, \phi_L)$ Formally:

$$\Pi^g_{LL} > \Pi^a_{LH} \iff$$
$$(1-\gamma)\left[\hat{R}^i(\theta_L, \phi_H) - \hat{R}^i(\theta_L, \phi_L)\right] > R^o_H - R^o_L - \gamma(R^g_{LH} - R^g_{LL}) \tag{3.11}$$

The insider's payoff presents the disappointment measure we introduced in (3.6), which makes the problem of comparison between the payoffs harder to solve. Notice that, however, both Π^i_{LH} and Π^i_{LL} may also be positive, since δ may be 0 and/or the insider's market power can be high enough to make $P^{ig}_{aigo}(\theta_L, \phi_k) > R^i_k + \hat{\delta}_k$. Artist's payoff in this path depends only on the Nature's choice for what concerns fame.
As one can see from Figures 3.5 and 3.6, the high-talented artist can sell her artworks only through the ago path among the paths we considered in our model; otherwise, when talent is low, she can choose the path she prefers depending on her expected payoff, who can obtain considering the probability τ to have ϕ_H or ϕ_L.

Claim 3.4 *Due to the existence of a uncertainty problem for the in-*

sider when buying from the artist, and to the presence of alternative trade channels besides $aigo$, the lemon problem in the art market is avoided. In particular, uncertainty implies that low-quality artworks do not drive high-quality ones from market, while the alternative paths in the art market can absorb the high-quality artworks. Despite the information problem present in the art market, high quality is not washed out.

Market power and asymmetric information may have either a positive or a negative effect on the players' payoffs, and then on the game's equilibrium: in fact, as we saw in the gallery's strategy in the ago path, the presence of asymmetric information reduces the surplus it can extract from the artist in the high-talent case, since this constrains the gallery to post a price which is independent on talent, while a higher market power against the artist (a lower β) would increase its payoff; on the other hand, the insider's imperfect information allows the artist to obtain a higher payoff than in a situation of perfect information in which the two agents would have bargained a price, and hence the lack of information has the same effect of a higher artist's market power (a higher α).

Finally, we can see that in both ago and $aigo$ path the total surplus will tend to be shared among the most informed agents (the artist and the gallery), while, in a situation in which information would be more spread, the collectors too would get a part of the total surplus. In order to make the surplus distribution among the agents more uniform, the policy maker could then convey information about the artists' talent to all the agents in the market; for example, an incentive could be given to the artists to reveal their true talent, as public art prizes or art contests and competitions do. Notice, however, that a policy like this could affect negatively the high-talented artists if the

real talent is not perfectly revealed, since a market without outsiders would reduce the channels through which high-quality artworks could flow.

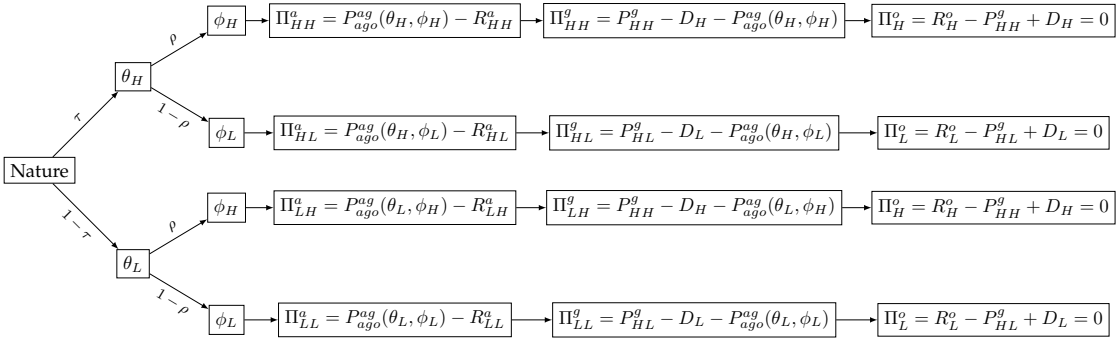


Figure 3.5: The *ago* channel

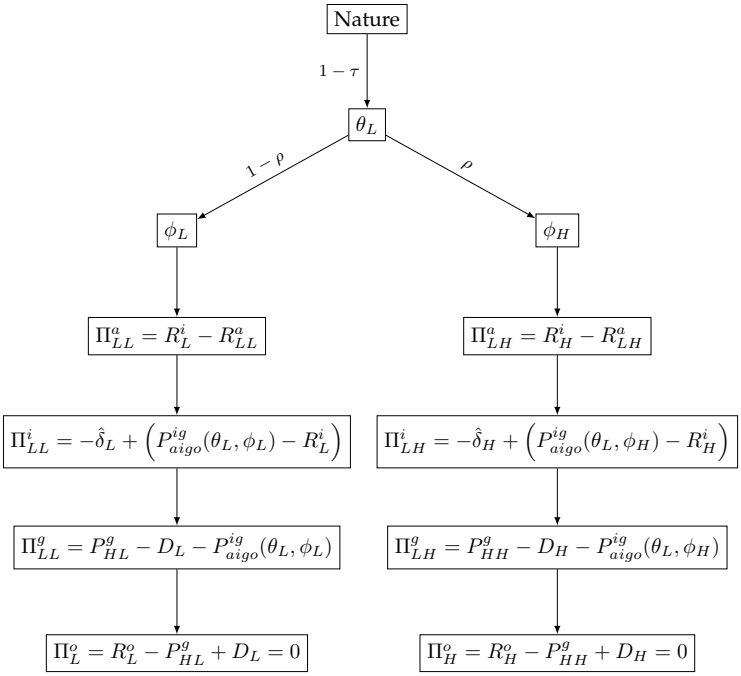


Figure 3.6: The $aigo$ channel

3.6 Conclusions

Using a bargaining theoretical framework, we model the art market's agents interaction and its effect on price formation in presence of asymmetric information about artwork's quality. In particular, we develop the model in Chapter 2 considering both artists' fame and talent, and their effect on artwork's quality, as well as how this quality is perceived by the insider and outsider collectors. Our behavioural pricing model predicts the emergence of undertreatment in case of credence goods (for the

outsider collectors, see Claim 3.1), and it exploits the concept of disappointment in the case of experience goods (for the insider collectors, see Claim 3.2); moreover, the search-good status of the artworks for galleries does not affect the galleries' behaviour in the market in case of absence of search costs (see Claim 3.3). Besides the behavioural pricing model, we carry a dual contribution to the literature: on one hand, we introduce the mechanism through which the artist's talent affects the cultural value of her artworks and, hence, their quality; on the other hand, we claim that the artist's fame, together with the artwork's quality, affects the economic value of the artwork, and, thus, the market price.

Given the market powers of the agents that operates in the artist-gallery-outsider and in the artist-insider-gallery-outsider channels, the distribution of the surplus among them is influenced by the information availability; in particular, the larger part of this surplus ends up in the hands of those agents who have an information advantage (artists and galleries), since they are able to play strategically and exploit this private information. However, given the artist's fame, it is not always true that a high-talented artist gains more than a low-talented one in selling one's artwork, since the ordering of artist's profits depends both on her technology of formation of posted price, given her reserve price, and on her market power. As regards the gallery, when it operates in the $aigo$ path, it may find more profitable to sell a low-talented and low-famed artist's artwork than a low-talented and high-famed artist's one, and this does not depend solely on its choices on its reserve prices. In the ago path, instead, the gallery will find always more profitable to sell a low-quality artwork than a high-quality one; in this path,

a low-talented artist may obtain a higher payoff than a high-talented one, both in the high-fame and in the low-fame case.
What emerges from our results is that the more information is available, the less the surplus will be concentrated; for this reason, a policy implication of our model is that a centralized policy maker or a neutral agent that would spread the information about artists' talent and artworks' quality could avoid that few agents in the market will gain most of the surplus. This result could also explain why prizes are widely used nowadays in the art world. On the other hand, the presence of the agents with low knowledge of the art market, the outsider, avoids the washing out of high-quality artworks from the market due to a lemon market effect (see Claim 3.4).
Our model is a static model, with rational expectations and risk-neutrality, so a further step that could be made would be to relax one or more of these hypothesis; for example, a dynamic model could consider both the fame-formation process and how the cultural value components evolve overtime thanks to their societal characteristic. In this case, each artist's fame will accumulate depending on her market performance, that is, the selling prices of her artworks; fame, at the same time, will affect her market power and, hence, her ability to obtain a higher price when she bargains. The market performance has an effect also on some of the components of the cultural value of her artworks, and then, indirectly, on their quality and prices. Consequently, reserve prices of all the agents adjust depending on the process of fame, while only for some agents the effect on cultural value implies a change on their reserve prices. Other potential dynamics that could appear are the accumulation of taste (or learning-by-consuming) in the outsider collec-

tors, who could become insider, changing the collectors population shares, and the emergence of addiction effect (Becker and Murphy, 1988). Furthermore, a seller could choose to behave non-opportunistically in order to accumulate a good reputation and, then, be preferred by collectors.
Finally, as the insider becomes more risk-adverse, the market could change its shape, with the increase of the share of artworks exchanged in certain channels that will be preferred to others. Another possible extension would consist in endogenizing the artist's market power, making it depend on her fame, or, in the dynamic context, the gallery's market power on its reputation.

Chapter 4

A new empirical measure of contemporaneous and modern artists' talent and fame

4.1 Introduction

In the last years, art masterpieces sold for record prices in both private and public market. For example in 2015, among the private selling, Willem de Kooning's "Interchange" sold for more than 300 millions of dollars, "Nafea Faa Ipoipo" made by Paul Gauguin sold for a similar price, while "Number 17A" by Jackson Pollock sold for around 200 millions of dollars. Among public selling at Christie's in New York, Pablo Picasso's "Les

Femmes d'Alger" sold for 179.4 millions of dollars, and "Nu Couch" by Amedeo Modigliani reached 170.4 millions of dollars. In Italy, in 2016, one of the artworks from the "Concetto spaziale. Attese" series by Lucio Fontana reached 1.323 millions of Euro at Sotheby's in Milan. In 2012, another Lucio Fontana's artwork from the same series sold for 3.181 millions of Euro in the Italian private art market by Gagosian Gallery. If one bases his valuations of artist's value only on these prices, he would say that Willem de Kooning, Paul Gauguin, Jackson Pollock, Amedeo Modigliani, and Lucio Fontana are very important artists, with a very high value, as indeed they are, being superstars whose value is recognized worldwide. In fact, the value of an artwork for the lay person can be measured by its market price, hence the artists' value can be measured and ranked with respect to their prices. But how can an artist be valued? Using her artworks' prices (or her last sold artwork's price) as a measure of an artist's value, however, is an unsophisticated and trivial method to compare her with other artists. On the other hand, for the art experts the artist's value cannot be measured, since it results from a societal judgement and makes the artists difficult to compare.[1] However, both dealers and collectors need an artists' ranking in order to build their portfolio of artists; in fact, the practitioners of the art market collect artists and not artworks, since the artworks are not anonymous but the artist's name influences the price of the artwork.[2] The main index available nowadays is the ArtFacts.net

[1] See Chapter 3.

[2] In the model in Chapter 2 the artist's name affects her market power, and hence the price. See also Chapter 3. Other scholars (Zorloni, 2005; Schroeder, 2005; Muñiz Jr. et al., 2014) too consider the artist's name as a brand, that has an effect on the price of her artworks.

index, a trademark of ArtFacts.net Ltd., which ranks the modern and contemporaneous artists with respect to a score, based on international auction houses' prices and other information which are not common knowledge (Quemin and van Hest, 2015). This index reflects, however, an international ranking, which is based only on the public market (auction market), that does not take into account neither the local nature of the art market, nor the price generated in the private market (gallery market).[3]

At the best of our knowledge, cultural economics literature did not consider the theoretical construction of an artist-related index, but it focused more on the study of the artworks' market value rather than studying the artists' market value, besides the studies focused on superstars started with the seminal works by Rosen (1981) and Adler (1985). Consequently, in the literature there are several works concerning the empirical price index of the art,[4] but there are no empirical studies on an artists' index, neither with a global nor with a local focus. A potential explanation of this gap in both the theoretical and the empirical literature is due to the prevalence of the idea that artists' value is unmeasurable and difficult to compare, and to the lack of available data on the private and local market. To bridge this gap, we propose a novel index of artist's value exploiting the idea that this value depends on the artist's fame and talent, and that these two individual characteristics are observable

[3]The government, on the other hand, starts to show the need to measure quality and value to better choose which projects to fund and by how much; one of the more recent example is the Quality Metrics by Arts Council England, a new tool to measure the quality of the works of the major funded organizations in UK, whose application to all the institutions funded for more than 250,000£ has been announced in September 2016 (Higgins, 2016; Romer, 2016).

[4]See Candela et al. (2002) and Ashenfelter and Graddy (2003).

and measurable.[5] Moreover, to make this index operational, we build it using a unique hand-collected dataset on private and public Italian art market that contains all the artworks' transactions intermediated by galleries and auction houses between 2007 and 2012.

Our empirical strategy consists in applying hedonic regression methods, both OLS and quantile regression, in order to estimate the artists' coefficients that we will use as a measure of the value of each artist.[6] This method allows to remove the effect of all the non-individual characteristics of an artwork from its price, so that we can measure the effect of the artists' individual characteristics on their artworks' prices by using artists' fixed effects; we cannot use a panel fixed effect approach since the resell of the same artwork is rarely observed.[7] The idea is that different artworks made by the same artist reflect an equal fixed effect.

Once we build our index, we could use it to answer to a series of questions: what is the distribution of this index? Is it sensitive to changes of variables such as time, art genre, price level, or market size and place? Do these variables affect the ranking that results from using the proposed index? Is there any dynamics of the coefficients with respect to these variables? Is it possible to identify common patterns or behaviours in these potential dynamics? To answer to these questions in this paper we empirically analyze the index distribution generated

[5] See Chapter 3 for an analysis of these two characteristics.

[6] Chanel et al. (1996) and Etro and Pagani (2013) used the artists' fixed effects to form a ranking, but without referring to artists' value, nor using more models to see if their ranking were robust.

[7] In fact, models such as the repeat sales model can be used only in the cases in which the same object has been sold more than once; see Ashenfelter and Graddy (2003) and Locatelli Biey and Zanola (2005).

from various regression models, as well as the robustness of the ranking obtained using this index. Finally, the behaviour of the coefficients in their dynamics is qualitatively studied.
The remainder of the paper is structured as follows. Section 4.2 contains an overview of the state of the art for what concerns the empirical investigations of the art market, and our contribution to this literature. Section 4.3 describes the unique dataset we use in our work and presents the empirical models we implement. Section 4.4 contains the results of our models and a discussion. Section 4.5 concludes.

4.2 Literature review: state of the art and our contribution

Within the cultural economics framework that covers the study of artists' characteristics and the artworks' price indices, the few studies that connect these two strands are the works on superstar theory, started by the seminal papers by Rosen (1981) and Adler (1985), in which two different theories of stardom are proposed, the former based on talent (the most talented artists tend to be the most famed, the stars), the latter on conversation (popularity/fame is increased by conversation among agents, and agents are more prone to talk about a popular artist than about a non-popular one).[8]
Economics scholars are interested in these two artists' characteristics since they affect the price of artworks. However, theoretical analysis of this market is not widespread, with only few models focusing on it; among these, MacDonald (1988)

[8]See also Adler (2006). Pretz (2016) contains a critique of these two models and introduces a third one based on overdetermination.

develops a stochastic model in which each artist has a certain probability of producing a high-quality artwork and the realizations of these probabilities influence her reputation; another model is the one we developed in Chapter 3, where artist's talent and fame affect the economic value (and hence the price) of her artwork in different way, the former indirectly, passing through the cultural value of the artwork and its quality, the latter directly. Other scholars suggest that quality has no effect on final price, since individuals in the art market are not able to perceive and valuate it without the help of an expert, and then reputation is the only characteristic of the artist that can have an effect on price (Bonus and Ronte, 1997). As we pointed out in Chapter 3, fame as well as cultural value components are societal value, in the sense that they are built through the consensus-formation mechanism at work in a certain society or community; this is in line with the point made by Quemin and van Hest (2015), that is, fame depends on the location in which it is evaluated, that is, there exists a "local" fame linked to the social space in which it is formed. In other words, there is a location effect on prices, due to the different perception of fame of the artists in different cities or countries, as confirmed by Vosilov (2015*a*). Empirical investigations in cultural economics on the fame characteristic have been carried through mainly in the study of the stardom and its dynamic (Hamlen, 1991, 1994; Chung and Cox, 1994; Cox and Felton, 1995; Crain and Tollison, 2002; Fox and Kochanowski, 2004; Filimon et al., 2011; Candela et al., 2016), with also application to soccer players (Lucifora and Simmons, 2003; Franck and Nüesch, 2008, 2012; Lehmann and Schulze, 2008) and gastronomy (Ehrmann et al., 2009). These studies, however, do not focus on each artist (or

player, or restaurant) in the market, in order to measure one or more of her characteristics and then to form a hierarchy of value based on them, but try to study the superstar effect on the income distribution. On the other hand, there exist some non-academic institutions that create charts of artists based on their fame, measured using a technique which is not disclosed, as for example the one used by ArtFacts.net, which is network-based and briefly explained by Quemin and van Hest (2015), but which is not replicable for the reason we just mentioned.
While, as we demonstrated above, fame has been considered in various studies in cultural economics, talent obtained less attention, mainly because it is difficult to observe and it does not have a dynamics, being it an innate characteristic (Towse, 2006). In the literature, at the best of our knowledge, only few studies considered this artist's characteristic under a theoretical point of view: Throsby (2006) investigates the role of talent and creativity in influencing the productivity of an artist; Champarnaud (2014) develops a stochastic model to study the price-to-quality relationship, determining how the connoisseurs and consumer without knowledge of the art behave with respect to artist's talent; in Chapter 3, we consider an artist's talent as a partially observable variable which affects the cultural value of her artwork, and, through its quality, its economic value and price. For what concerns empirical investigations, Candela et al. (2016), using a factor analysis, create a measure for talent (and one for fame) to check Rosen's and Adler's theories.

So, how can this individual index of artist's talent and fame, or reputation, or in general characteristics that have an effect on her artworks' price, be identified? A way that has been used only a few times with this goal in literature is the hedonic re-

gression; the idea is to use the artist's fixed effect coefficient from an hedonic regression as an index of its importance in the market, as Chanel et al. (1996) and Etro and Pagani (2013) did. But how does hedonic regression work? Hedonic regression has been modeled by Rosen (1974), as a regression in which the price of a series of goods belonging to a certain category (for example, estates, artworks, etc.) is regressed against the characteristics of these goods, so that the coefficient of each of the covariates in the regression captures the partial effect on the price that each of these characteristics has (see also Candela and Scorcu, 2004). The model is based on the conceptualization of the consumer theory made by Lancaster (1966), for which each good is evaluated by the consumer by considering its characteristics: in other words, the consumers give value to each of the characteristics of the good, and not directly to the good itself. The hedonic regression is, then, one of the more straightforward way to measure which is the contribution to the good's price of each of its characteristics.

Hedonic regression has been widely applied to the analysis of the determinants of artworks' prices and the effect of the artworks' and their artists' characteristics on the prices themselves, as, for example, in the works by Chanel et al. (1996), Rengers and Velthuis (2002), Candela et al. (2002), Angelini (2012), Renneboog and Spaenjers (2013), Georges and Seçkin (2013), and Pradier et al. (2016); since the hedonic regression, also called the "grey painting" method, allows to generate an index of artworks' price without the effect of their characteristics, it can be used also to evaluate art market's relationship with other markets, as for example the financial market, as in Anderson (1974), Chanel (1995), Ginsburgh and Jeanfils (1995),

Agnello and Pierce (1996), Flôres et al. (1999), and Kräussl et al. (2016),[9] but also to consider non-market effects on prices, as, for example, the effect of home bias or of experts opinions on prices (see Vosilov, 2015*a*,*b*), or the artists' career peaks (Hellmanzik, 2009), as well as to be used in a comparison with new indices for the art market (Candela et al., 2004).

Besides the OLS hedonic regression we just reviewed, the hedonic approach have been also used together with other models in applications to the art market, as for example the autoregressive multilevel regression by Modugno et al. (2015) and its stochastic version by Cagnone et al. (2016), the hybrid model by Locatelli Biey and Zanola (2005) that uses together the repeated sales and the hedonic approach, the sample-bias correction la Heckman of the hedonic regression developed by Collins et al. (2009), and the hedonic panel estimation used by Ursprung and Wiermann (2011). Besides these application, also a combination of quantile regression and hedonic regression has been used in cultural economics literature, as firstly explained by Scorcu and Zanola (2011), and then applied by Renneboog and Spaenjers (2013), Vosilov (2015*a*,*b*) and Candela et al. (2016). Quantile regression, a model introduced by Koenker and Bassett (1978) and further explained in Koenker and Hallock (2001), consists in "the estimation of conditional quantile functions, models in which quantiles of the conditional distribution of the response variable are expressed as functions of observed covariates" (Koenker and Hallock, 2001, p.143); in other words, given the distribution of the dependent variable, this technique allows to explain what is the effect of a

[9] Table 1 in Ashenfelter and Graddy (2003) (p. 769) reports other studies which use hedonic regression in order to compute art market returns.

series of covariates in a certain conditional quantile function of the dependent variable, as for example the median, or the third quartile. This method allows, then, to check if the effect of a covariate changes depending on the quantile of the dependent variable that is taken into account.

4.3 Data and empirical models

In this section we first present our data, in Subsection 4.3.1, and then we introduce the models we use for the construction of the artists' indices, in Subsection 4.3.2.

4.3.1 Data description

We base our empirical analysis on a unique hand-collected dataset from the Artist Re-sale Rights (ARR) archives of the Società Italiana degli Autori ed Editori (SIAE), the public Italian society which handles royalty disbursement for artists.[10] From the ARR archives of the SIAE, we collected all available information (artist, dealer, artwork, price, etc.) about all the sales involving professional intermediaries that occurred in Italy in the period from the beginning of the application of the ARR laws in Italy (February 2006) to the end of March 2013. The first year, 2006, besides being incomplete if we take into account solar years, presents a lot of discontinuity in the reports of the selling, as if the system slowly adopted the new law; another possible explanation is that the market acted in an unusual way.

[10] In Italy, when an artwork is resold in the secondary art market by auction houses or art galleries, SIAE is entitled by law to collect and distribute royalties to the artist or his/her descendants. In most European Countries a similar system is at work, as established by the EU Directive 2001/84/CE.

Whichever of these two explanations is the real one, we decided to drop the selling occurred in 2006, as well as the ones occurred in the first months of 2013, since in this case there is a potential lack of reports due to the fact that the professional intermediaries have 3 months to declare the selling. We are left, then, with six full years of selling, from the beginning of January 2007 to the end of December 2012.
Our dataset is characterized by some important features. We consider only artworks with a minimum sale price of 3,000€, as the ARR applies only this price class. All artworks considered are produced by artists who are alive or who died less than 70 years before their selling, which is the range of application of the ARR. The dataset contains information on transactions about artists who sold at least 2 artworks in each of the 6 years considered, resulting in a total of 230 artists and 25,197 transactions.
Table 4.1 contains transaction-level descriptive statistics about the variables of the dataset. As we can see, the artworks' prices have a very large variability, with a range that goes from 3,000€ to 3,181,076.70€, hence we use the natural logarithm of the prices in all the models in order to reduce this variability.

The other variables in the dataset can be divided into two groups: the artist-specific characteristics, regarding information about the artists, among which we have sex, a dummy equal to 1 if the artist is male, $Italy$, a dummy equal to 1 if the artist has Italian citizenship, $son\ of\ artists$, a dummy which is equal to 1 if the artist's father and/or mother were artists, $art\ studies$, a dummy equal to 1 if the artist studied in an art school, $multiple\ genres$, a dummy equal to 1 if the artist's works belong to more than one genre, $year\ of\ birth$, $living\ artist$, a dummy equal to

Table 4.1: Transaction-level descriptive statistics

	Obs.	Average	St. Dev.	Min	Max
$price$	25197	27303.37	83796.72	3000.00	3181076.70
$\ln(price)$	25197	9.38	1.06	8.01	14.97
$share_t$	25197	0.05	0.06	0.0002	0.20
$share_{tot}$	25197	0.04	0.05	0.00004	0.15
$public$	25197	0.46	0.50	0	1
$house$	25197	0.46	0.50	0	1
$gallery$	25197	0.50	0.50	0	1
$other\ sellers$	25197	0.03	0.17	0	1
$antique\ dealer$	25197	0.01	0.11	0	1
$painting$	25197	0.74	0.44	0	1
$photography$	25197	0.01	0.09	0	1
$drawing$	25197	0.03	0.16	0	1
$graphics$	25197	0.01	0.12	0	1
$sculpture$	25197	0.07	0.26	0	1
$other\ genres$	25197	0.09	0.28	0	1
$Italy$	25197	0.83	0.37	0	1
sex	24414	0.97	0.16	0	1
$living\ artist$	24414	0.35	0.48	0	1
$year\ of\ birth$	24414	1921	23,50	1856	1977
$multiple\ genres$	24414	0.83	0.38	0	1
$son\ of\ artists$	24414	0.11	0.32	0	1
$art\ studies$	24414	0.76	0.43	0	1

Notes: $price$ is in Euro. Averages and standard deviations are rounded at the second digits when larger than 0.005, besides $year\ of\ birth$ average which is rounded to the nearest integer.

1 if the artist was alive in the years the dataset is about,[11] and the transaction-specific characteristics, as $price$ (and its natural logarithm $\ln(price)$), $art\ genre$ (divided into $painting$, $drawing$, $photography$, $graphics$, $sculpture$, and $other\ genres$), $seller$ (divided into $house$, for auction houses, $gallery$, $antique\ dealer$, and $other\ sellers$),[12] $share_{tot}$ and $share_t$, the seller's shares of

[11] In the period 2007-2012, 6 artists died and hence the variable is not time-invariant.

[12] The variable $public$ refers to public prices, that, as we pointed out in Chap-

Table 4.2: Artist-specific descriptive statistics

	Obs.	Average	St. Dev	min	max	Total
sex	230	0.98	0.13	0	1	226
multiple genres	230	0.81	0.39	0	1	186
living artist	229	0.42	0.49	0	1	95
son of artists	225	0.09	0.29	0	1	20
artstudies	226	0.73	0.44	0	1	165
Italy	230	0.83	0.38	0	1	191
year of birth	230	1923	26.13	1856	1977	/
number of transactions	230	109.55	110.82	14	765	25197
artist's price average	230	24649.37	34074.22	3847.06	320864.58	/

Notes: Averages and standard deviations are rounded at the second digits, besides *year of birth* average which is rounded to the nearest integer.

the market in the whole period (the former) and in the year in which the transaction occurred (the latter). Some of the variables have not a value for each transaction, since information about artists and sellers are missing, as well as, in some cases, also about the artworks sold: for example, artistic genre is available for 23862 transactions. Table 4.2 reports the artist-specific descriptive statistics. Most of the artists about which data are available are male, work on more than one medium, studied in an art school, and are Italian; less than 10% are sons of artists. The dataset covers artists which are born between 1856 (Attilio Pratella) and 1977 (Valerio Berruti), with a total number of transactions in the considered period which goes from 14 to 765, with a mean of 109.55. Artists' price averages has an average equal to 24,649.37 Euro, and it ranges from 3847.06 Euro to 320,864.58 Euro; as we can see from the standard deviation, it tends to be very disperse. The only time-variant variable about artists, *living artist*, is not reported in Table 4.2.

Table 4.3 contains the year-by-year means of the covariates used and of the artist-specific variables; as one can see, the bun-

ter 2, are those of the artworks sold by auction houses.

Table 4.3: Year-by-year covariates' and artist-specific variables' averages

	year 1	year 2	year 3	year 4	year 5	year 6
Italy	0.84	0.83	0.83	0.83	0.83	0.85
sex	0.98	0.96	0.99	0.98	0.98	0.96
multiple genres	0.84	0.81	0.84	0.85	0.84	0.81
living artist	0.34	0.35	0.33	0.38	0.34	0.37
son of artist	0.10	0.14	0.09	0.11	0.09	0.13
art studies	0.74	0.76	0.74	0.78	0.78	0.76
public	0.43	0.54	0.49	0.43	0.43	0.39
house	0.43	0.54	0.49	0.43	0.43	0.39
gallery	0.54	0.43	0.48	0.52	0.48	0.55
antique dealer	0.01	0.01	0.01	0.01	0.02	0.004
other sellers	0.01	0.02	0.02	0.03	0.07	0.05
other genres	0.08	0.07	0.08	0.07	0.13	0.09
drawing	0.03	0.02	0.02	0.03	0.03	0.02
photography	0.01	0.01	0.01	0.01	0.01	0.02
graphics	0.01	0.01	0.02	0.02	0.02	0.01
painting	0.76	0.75	0.72	0.76	0.71	0.74
sculpture	0.05	0.09	0.07	0.06	0.06	0.09

Notes: Averages are rounded at the second digits when larger than 0.005.

dle of artists whose artworks are sold in each years has a stable set of characteristics; slight variations are present on the shares of the art market that galleries and auction houses have overtime, while the distribution of techniques is almost stable overtime, with paintings that constitutes always more than 70% of exchanged artworks.

Table 4.4 contains information about the prices of artworks sold in each years. Prices tend to have a stable average overtime, besides the slightly higher average in 2012, in which also the largest price of all the dataset is observed (3,181,076.70€, obtained from the selling of one of the artworks from Lucio Fontana's "Concetto spaziale. Attese" series). From Table 4.4

we can also see that the number of transactions decreases in 2009, maybe as a result of the crisis began in the fall of 2008; this is reflected in the total value of exchanges, which dropped from over 163 millions of Euro in 2008 to 73 millions of Euro in 2009, and then stabilized to slightly over 100 millions of Euro from 2010 to 2012.

Table 4.4: Year-by-year descriptive statistics for $price$

	Obs.	Average	St. Dev.	Min	Max	Total
year 1	5117	26229.30	86975.86	3000	3000000	134215325.32
year 2	6165	26486.87	70341.51	3000	1675000	163291536.67
year 3	2997	24460.87	72341.28	3000	2600000	73309247.20
year 4	4004	26945.75	73503.99	3000	2300000	107890766.88
year 5	3770	27259.48	87793.85	3000	2750000	102768223.77
year 6	3144	33870.19	114486.37	3000	3181076.70	106487872.66

Notes: Averages and standard deviations are rounded at the second digits.

Table 4.5 reports the quartile-by-quartile descriptive statistics for the variable $price$. As one can see, variability increases as we move to higher quartiles, and hence our choice to use the logarithm of $price$ as dependent variable in our models is justified by the non-linearity the data present.

Table 4.5: Quartile-by-quartile descriptive statistics for $price$

	Obs.	Average	St. Dev.	Min	Max
First quartile	6787	4041.59	669.32	3000	5000
Second quartile	6633	7488.97	1513.35	5015	10000
Third quartile	5478	15083.48	3128.75	10000.80	21600
Fourth quartile	6299	83859.51	154126.59	21666.67	3181076.70

Notes: Averages and standard deviations are rounded at the second digits.

4.3.2 Empirical models

The models we use in this paper are the hedonic OLS regression and the hedonic quantile regression. The first model has the following form:

$$ln(P_i) = k + \beta X_i' + \beta_j A_j + \tau_t I_{t,i} + \epsilon_i \tag{4.1}$$

where i refers to the transaction i, created by the artist j and sold at time t, with $j = 1, ..., 230$ and $t = 1, ..., 6$. In equation (4.1), k is the constant, X_i contains the covariates which describe transaction i, A_j is the artist j's fixed effect,[13] τ_t is year t fixed effect and $I_{t,i}$ is the indicator function that is equal to 1 when the artwork i is sold in year t, while ϵ_i is the residual, that respects by assumption the hypotheses for the OLS regression. The OLS regression allows us to check what are the artists' effects once we removed all the other artwork- and transaction-specific effects on price, so that we are able to identify the artist's contribution to the price and use it as her index. Moreover, depending on the sub-sample we use in the computation, we can focus on some specific characteristics of the artwork (i.e. the art genre, studying what is the artists' ranking using our index computed only on paintings) or of the market (i.e. considering only one year and seeing if there is some specific effect on the coefficients behaviour).
The quantile regression model, applied using a hedonic approach, allows us to consider a potential price effect on our index behaviour, as well as to check if some cross-effects exists.

[13] Table B.1.1 contains the correspondence between the j-s and the artists' names.

The model we use is the following:

$$Q_{ln(P)}(q|A,t,X) = k_q + \tau_{q,t} I_{t,i} + \beta_{qj} A_j + \gamma_q X_i' + \epsilon_{iq} \quad (4.2)$$

where $Q_{ln(P)}(q|A,t,X)$ is the conditional quantile function for the quantile q of the distribution of $ln(P)$, given the artists' fixed effects, the years fixed effects, and a set of covariates X. In both models, the covariates we are going to use will be different in each estimation, and hence we will characterize X before presenting each one of the results.

4.4 Results

In this section, we present the results of the estimation of the models we introduced in Section 4.3. In particular, Subsection 4.4.1 contains the estimation of the OLS regression on all the data, our benchmark model, Subsection 4.4.2 reports the results of the estimations of the model with the variables describing the art genres and of the models on the sub-samples of the main of these art genres, Subsection 4.4.3 reports the year-by-year estimation results computed using the OLS hedonic regression, while Subsection 4.4.4 and 4.4.5 contain respectively the estimation of the hedonic quantile regression on all the data and on the sub-samples of each of the 6 years. Finally, Subsection 4.4.6 contains an analysis of the artists' ranking in the various models and of the dynamics overtime of the year-by-year OLS artists' coefficients and the of the quantile-by-quantile behaviour of the estimated artists' coefficients.

4.4.1 The benchmark model: Hedonic OLS regression

The results presented in this subsection are those of the model obtained taking (4.1) and using, as covariates, the variables $art\,genre$, $public$, and $share_t$, besides the time dummies and the artists' dummies; all the available observations are used. The estimated model, that we will use as a benchmark, is:

$$ln(P_i) = k + \gamma_1 art\,genre + \gamma_2 public + \gamma_3 share_t + \\ + \beta_j A_j + \tau_t I_{t,i} + \epsilon_i \tag{4.3}$$

with $j = 1, ..., 230$, and $t = 2, ..., 6$.[14] The results of the OLS estimation are contained in Table 4.6. The resulting estimated coefficients for the artists, obtained using the backward stepwise method with a significance level of 0.1, are 126 and range from -1.15 to 2.33.[15] Among the other covariates, those significantly different from 0 are the time fixed effect for 2008, 2010, and 2012, and are all greater than 0, meaning that the effect in the even years is significant with respect to the odd years; a possible explanation is that there is a cycle that lasts two years, with a peak in each of the even years.

In Figure 4.1, we plot the normal kernel density of the artists' coefficients that result to be significantly different from 0.[16] A clear bimodal distribution can be recognized, with a higher

[14] Hereafter, year 1 dummy is not added to the models in order to avoid the dummy trap issue. We always use all the artists' fixed effect, given that at least one of them is dropped because not significant in each estimation we make.

[15] Recall that, having as a dependent variable the logarithm of price, these coefficients are semi-elasticities and not direct effect on price. However, we can use them to generate an ordinal ranking of the artists.

[16] The kernel function used in the computation of this density is the Epanechnikov's. Hereafter, all the kernel density estimation will be carried through using the same function.

probability concentrated in the lower peak. This is true also using the ArtFacts.net data we referred to above, that can be considered as the coefficients of the worldwide public market, that is, auction houses market; Figure 4.2 contains the kernel density of these scores.[17] Since ArtFacts.net ranking is made using public prices only, we also plotted the distribution of the OLS regression coefficients obtained from the Italian public prices only (Panel 4.3a) to better compare the distributions; Panel 4.3b contains the kernel density of the artists' coefficients obtained using the private prices only. Both the kernel distributions in Figure 4.3 present a strong bimodal form.

Using other works' data, that is, Chanel et al. (1996), Georges and Seçkin (2013), and Pradier et al. (2016), we generated kernel density distribution also for the artists' coefficients from these works, finding a bimodal distribution in both of them (see, respectively, Figure 4.4a, Figure4.4b, and Figure 4.4c).[18] In particular, the distribution in Pradier et al. (2016) presents a more probable smaller peak and a less probable higher peak, as in our results from Table 4.6, while Chanel et al. (1996) and Georges and Seçkin (2013) distributions have a larger probability for higher levels of the coefficients.

[17] In particular, we downloaded the available score from ArtFacts.net and removed the names that appeared twice, ending up with 236,239 artists. As one can see from the figure, the scale is quite different from ours, but the distribution presents two peaks as in our results. As we will see, Georges and Seçkin's, Pradier et al.'s, and Chanel et al.'s x-scale is different from the ArtFacts.net one, and similar to ours.

[18] The data from Chanel et al. (1996) have been hand-collected from their Table 1, pp.10-11, data from Georges and Seçkin (2013) have been hand-collected from their Table 3, pp.47-48, while data from Pradier et al. (2016) have been hand-collected from their Table 10 in Appendix 1, pp.474-478. In drawing the graphs, we used only statistically significant coefficients with a confidence level of 0.1. Among these two studies, only Chanel et al. (1996) and Georges and Seçkin (2013) used the artists' coefficients as indices to rank the artists.

Table 4.6: Benchmark model: Hedonic regression on overall data

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.210	0.053	0.000	$A149$	0.542	0.080	0.000
$A2$	0.161	0.058	0.006	$A150$	-0.351	0.103	0.001
$A3$	0.897	0.097	0.000	$A151$	-0.900	0.041	0.000
$A4$	-1.017	0.051	0.000	$A152$	-0.922	0.041	0.000
$A5$	-0.208	0.066	0.002	$A153$	-0.915	0.041	0.000
$A6$	-0.884	0.068	0.000	$A154$	-0.765	0.065	0.000
$A7$	-0.922	0.055	0.000	$A155$	-0.231	0.091	0.011
$A8$	0.586	0.166	0.000	$A156$	-0.380	0.061	0.000
$A9$	-0.728	0.122	0.000	$A159$	-0.697	0.046	0.000
$A11$	-0.343	0.033	0.000	$A160$	-0.241	0.091	0.008
$A12$	-1.082	0.039	0.000	$A161$	-0.986	0.054	0.000
$A13$	-0.807	0.062	0.000	$A163$	0.419	0.063	0.000
$A14$	-0.993	0.063	0.000	$A164$	0.372	0.119	0.002
$A15$	0.137	0.073	0.060	$A165$	-0.392	0.100	0.000
$A16$	0.960	0.182	0.000	$A166$	-0.610	0.106	0.000
$A17$	0.613	0.137	0.000	$A167$	-0.806	0.046	0.000
$A18$	-0.772	0.063	0.000	$A168$	-0.406	0.044	0.000
$A19$	-0.548	0.175	0.002	$A169$	-0.553	0.088	0.000
$A20$	-0.646	0.086	0.000	$A172$	-1.008	0.038	0.000
$A22$	-0.461	0.062	0.000	$A175$	0.373	0.074	0.000
$A23$	-0.906	0.082	0.000	$A176$	-0.449	0.069	0.000
$A24$	-0.909	0.064	0.000	$A178$	0.492	0.094	0.000
$A25$	-0.440	0.057	0.000	$A179$	-1.020	0.069	0.000
$A27$	-0.526	0.090	0.000	$A180$	-0.800	0.047	0.000
$A28$	-0.589	0.056	0.000	$A182$	-0.205	0.082	0.012
$A100$	-0.785	0.040	0.000	$A183$	1.393	0.116	0.000
$A101$	-0.902	0.031	0.000	$A184$	-0.221	0.130	0.089
$A103$	-0.595	0.089	0.000	$A185$	-0.321	0.094	0.001
$A104$	-0.746	0.065	0.000	$A186$	-0.740	0.071	0.000
$A105$	-0.472	0.049	0.000	$A187$	-0.894	0.055	0.000
$A106$	-0.141	0.063	0.025	$A188$	0.154	0.057	0.007
$A107$	-0.190	0.093	0.041	$A189$	-0.262	0.043	0.000
$A108$	0.830	0.078	0.000	$A190$	-0.823	0.049	0.000
$A110$	-0.613	0.076	0.000	$A191$	-0.579	0.079	0.000
$A111$	-0.372	0.117	0.002	$A193$	-0.436	0.063	0.000
$A112$	1.850	0.297	0.000	$A194$	-0.207	0.043	0.000
$A113$	0.810	0.193	0.000	$A197$	-0.324	0.099	0.001
$A114$	-0.779	0.065	0.000	$A198$	-0.264	0.116	0.024
$A115$	-0.968	0.029	0.000	$A200$	-0.643	0.080	0.000
$A117$	0.434	0.191	0.023	$A201$	-0.784	0.046	0.000
$A118$	-0.895	0.039	0.000	$A202$	-0.257	0.048	0.000
$A120$	-0.585	0.060	0.000	$A204$	0.679	0.096	0.000

$A121$	-0.248	0.055	0.000	$A206$	0.712	0.088	0.000
$A122$	-1.150	0.033	0.000	$A207$	-0.349	0.115	0.002
$A123$	-0.700	0.080	0.000	$A208$	-0.935	0.059	0.000
$A124$	-0.877	0.043	0.000	$A209$	-0.353	0.061	0.000
$A127$	-0.348	0.192	0.069	$A210$	-0.794	0.065	0.000
$A128$	-0.189	0.052	0.000	$A211$	-0.765	0.054	0.000
$A129$	-0.371	0.047	0.000	$A212$	1.063	0.121	0.000
$A130$	2.329	0.203	0.000	$A213$	0.958	0.073	0.000
$A131$	-0.304	0.170	0.073	$A214$	-0.493	0.100	0.000
$A132$	-1.149	0.091	0.000	$A215$	-0.617	0.095	0.000
$A135$	1.002	0.093	0.000	$A216$	-0.431	0.068	0.000
$A136$	0.815	0.144	0.000	$A217$	0.413	0.101	0.000
$A137$	-0.159	0.085	0.062	$A218$	-0.312	0.039	0.000
$A139$	0.464	0.162	0.004	$A220$	-0.947	0.092	0.000
$A140$	-0.512	0.091	0.000	$A221$	0.792	0.072	0.000
$A141$	-0.527	0.079	0.000	$A222$	-0.714	0.088	0.000
$A143$	0.924	0.090	0.000	$A223$	0.618	0.068	0.000
$A144$	-0.684	0.039	0.000	$A224$	0.145	0.051	0.005
$A145$	0.985	0.128	0.000	$A225$	-0.608	0.052	0.000
$A147$	-0.135	0.082	0.100	$A229$	-0.578	0.130	0.000
$A148$	-0.650	0.075	0.000	$A230$	0.308	0.107	0.004
$art\,gen$	0.071	0.005	0.000	t_2	0.050	0.015	0.001
$public$	-0.192	0.017	0.000	t_4	0.045	0.018	0.011
$share_t$	-1.064	0.120	0.000	t_6	0.087	0.020	0.000
k	9.272	0.026	0.000				
Obs.	25197						
R^2_{adj}	0.213						

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_t$, t_2, t_3, t_4, t_5, t_6. Robust standard error are reported. All results are rounded at the third digit.

Our first result is as follows.

Claim 4.1 *The distribution of the artists' coefficients presents a strong bimodal form, with a higher peak for low levels of the coefficient and a lower peak for high levels.*

As a robustness check, we computed the OLS coefficients using the same set of covariates without $share_t$, the same set substituting $share_{tot}$ to $share_t$, and the same set using a unique variable $year$ with six levels instead of the six dummies for the years, and we obtained similar results for what concerns the

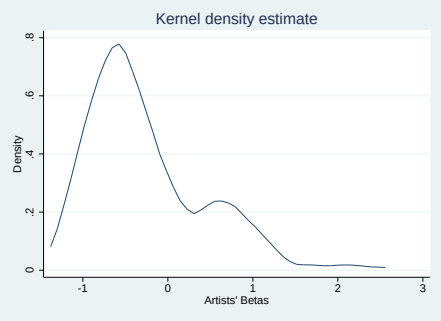


Figure 4.1: Distribution of artists' coefficients from model (4.3)

distribution of the artists' coefficients, that is, bimodality is robust in the benchmark model using all the data. We also tried to compute the model in Equation (4.3) using the truncated regression method instead of the standard OLS regression, but again the resulting coefficients maintain the bimodal distribution.[19]

4.4.2 The models for art genres on overall data and art-genre sub-samples

Could the results of the previous subsection be due to something that $art\,genre$ cannot capture, given that it is a unique variable with six levels? To check for this potential issue we computed the model in Equation (4.3) substituting $art\,genre$ with $painting$, $photography$, $drawing$, $graphics$, $sculpture$, and

[19] All the results from the robustness checks explained above are not reported here, nor in the Appendices, but are available upon request.

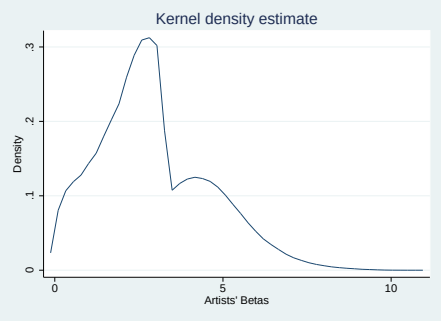
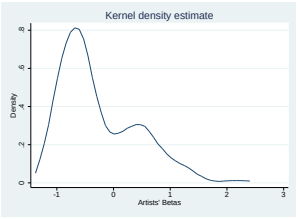
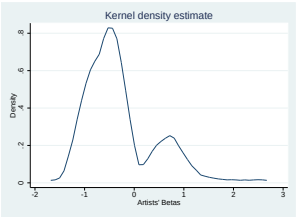


Figure 4.2: Distribution of artists' indices from ArtFacts.net data



(a) Public prices



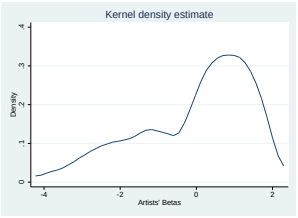
(b) Private prices

Figure 4.3: Distribution of artists' coefficients for public and private prices in the Italian market

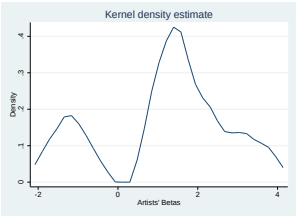
$other\ genres$.[20] Results are reported in Table 4.7.

$$\begin{aligned} ln(P_i) = k &+ \gamma_1 public + \gamma_2 share_t + \gamma_3 painting + \\ &+ \gamma_4 drawing + \gamma_5 sculpture + \gamma_6 photography \\ &+ \gamma_7 graphics + \gamma_8 other\ genres + \\ &+ \beta_j A_j + \tau_t I_{t,i} + \epsilon_i \end{aligned} \tag{4.4}$$

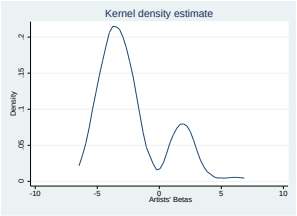
[20]We use all the 6 variables without incurring in the dummy variables trap because information about the genre is available for 23862 over 25197 observations.



(a) Chanel et al. (1996) data



(b) Georges and Seçkin (2013) data



(c) Pradier et al. (2016) data

Figure 4.4: Distribution of artists' coefficients, using data from other studies

with $j = 1, ..., 230$, and $t = 2, ..., 6$.

The stepwise procedure drops only the $other\,genre$ variable, which is very heterogenous since it accounts for every artwork which is not a painting, a drawing, a sculpture, a photography, or a graphics; all the other five variables are statistically significant. Four artists' coefficients estimated in the benchmark model are not in the final model in the current specification after the stepwise method is applied (the coefficients are those for $A106$, $A131$, $A147$, and $A15$), but five coefficients that were not significantly different from 0 in the first model are estimated in the current model ($A119$, $A158$, $A181$, $A196$, and $A199$), so

we estimated 127 artists' coefficients that are statistically significant at 90%. Among the estimated coefficients, only the constant, the coefficient for $public$ and the index for $A175$ are different in the two models taking into account a confidence interval of 95%, but this does not affect the ranking of the artist if we take into consideration a 95% interval around the indices. Coefficients for the other covariates slightly changed, but are not statistically different from the estimates in Table 4.6.
Figure 4.5 is the kernel density estimation of the distribution of the coefficients from the model in Equation (4.4). As one can see, the distribution is very similar to the benchmark model's one, in Figure 4.1.

Table 4.7: The art genres' model on overall data

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.167	0.051	0.001	$A153$	-0.945	0.040	0.000
$A2$	0.175	0.057	0.002	$A154$	-0.794	0.063	0.000
$A3$	0.954	0.089	0.000	$A155$	-0.247	0.089	0.005
$A4$	-1.048	0.047	0.000	$A156$	-0.413	0.057	0.000
$A5$	-0.209	0.067	0.002	$A158$	0.320	0.167	0.056
$A6$	-0.921	0.065	0.000	$A159$	-0.734	0.044	0.000
$A7$	-0.923	0.059	0.000	$A160$	-0.239	0.092	0.009
$A8$	0.562	0.163	0.001	$A161$	-1.008	0.053	0.000
$A9$	-0.787	0.119	0.000	$A163$	0.411	0.059	0.000
$A11$	-0.384	0.035	0.000	$A164$	0.334	0.118	0.005
$A12$	-1.122	0.040	0.000	$A165$	-0.428	0.098	0.000
$A13$	-0.851	0.061	0.000	$A166$	-0.629	0.103	0.000
$A14$	-1.040	0.062	0.000	$A167$	-0.861	0.046	0.000
$A16$	0.755	0.162	0.000	$A168$	-0.431	0.043	0.000
$A17$	0.664	0.127	0.000	$A169$	-0.547	0.090	0.000
$A18$	-0.821	0.063	0.000	$A172$	-1.068	0.035	0.000
$A19$	-0.707	0.138	0.000	$A175$	0.622	0.075	0.000
$A20$	-0.660	0.088	0.000	$A176$	-0.453	0.067	0.000
$A22$	-0.500	0.061	0.000	$A178$	0.442	0.094	0.000
$A23$	-0.928	0.083	0.000	$A179$	-1.084	0.061	0.000
$A24$	-0.934	0.064	0.000	$A180$	-0.830	0.046	0.000
$A25$	-0.477	0.055	0.000	$A181$	-0.242	0.126	0.055
$A27$	-0.558	0.089	0.000	$A182$	-0.235	0.082	0.004
$A28$	-0.625	0.056	0.000	$A183$	1.407	0.110	0.000

$A100$	-0.805	0.040	0.000	$A184$	-0.249	0.126	0.048
$A101$	-0.933	0.031	0.000	$A185$	-0.361	0.093	0.000
$A103$	-0.645	0.090	0.000	$A186$	-0.804	0.074	0.000
$A104$	-0.761	0.065	0.000	$A187$	-0.929	0.055	0.000
$A105$	-0.502	0.048	0.000	$A188$	0.183	0.057	0.001
$A107$	-0.323	0.091	0.000	$A189$	-0.256	0.040	0.000
$A108$	0.817	0.075	0.000	$A190$	-0.861	0.049	0.000
$A110$	-0.570	0.066	0.000	$A191$	-0.621	0.071	0.000
$A111$	-0.419	0.115	0.000	$A193$	-0.449	0.060	0.000
$A112$	1.793	0.298	0.000	$A194$	-0.255	0.042	0.000
$A113$	0.750	0.198	0.000	$A196$	-0.085	0.035	0.015
$A114$	-0.892	0.064	0.000	$A197$	-0.353	0.099	0.000
$A115$	-1.003	0.029	0.000	$A198$	-0.330	0.110	0.003
$A117$	0.455	0.164	0.005	$A199$	0.280	0.129	0.030
$A118$	-0.934	0.037	0.000	$A200$	-0.688	0.080	0.000
$A119$	0.350	0.153	0.022	$A201$	-0.824	0.044	0.000
$A120$	-0.624	0.057	0.000	$A202$	-0.241	0.047	0.000
$A121$	-0.281	0.054	0.000	$A204$	0.757	0.102	0.000
$A122$	-1.180	0.040	0.000	$A206$	0.655	0.088	0.000
$A123$	-0.727	0.080	0.000	$A207$	-0.402	0.113	0.000
$A124$	-0.944	0.039	0.000	$A208$	-0.993	0.055	0.000
$A127$	-0.413	0.185	0.025	$A209$	-0.395	0.060	0.000
$A128$	-0.214	0.052	0.000	$A210$	-0.835	0.062	0.000
$A129$	-0.411	0.045	0.000	$A211$	-0.794	0.053	0.000
$A130$	2.291	0.194	0.000	$A212$	1.031	0.117	0.000
$A132$	-1.181	0.083	0.000	$A213$	0.857	0.072	0.000
$A135$	0.994	0.088	0.000	$A214$	-0.551	0.094	0.000
$A136$	0.732	0.125	0.000	$A215$	-0.682	0.084	0.000
$A137$	-0.198	0.082	0.016	$A216$	-0.484	0.063	0.000
$A139$	0.485	0.161	0.003	$A217$	0.420	0.093	0.000
$A140$	-0.574	0.088	0.000	$A218$	-0.339	0.038	0.000
$A141$	-0.550	0.070	0.000	$A220$	-0.962	0.091	0.000
$A143$	0.867	0.094	0.000	$A221$	0.757	0.070	0.000
$A144$	-0.722	0.039	0.000	$A222$	-0.738	0.096	0.000
$A145$	1.018	0.109	0.000	$A223$	0.595	0.065	0.000
$A148$	-0.709	0.076	0.000	$A224$	0.087	0.052	0.094
$A149$	0.529	0.078	0.000	$A225$	-0.646	0.050	0.000
$A150$	-0.391	0.105	0.000	$A229$	-0.458	0.125	0.000
$A151$	-0.964	0.038	0.000	$A230$	0.298	0.102	0.003
$A152$	-0.943	0.042	0.000	$draw.$	-0.636	0.037	0.000
t_2	0.050	0.015	0.001	$graph.$	-0.771	0.042	0.000
t_4	0.051	0.017	0.003	$sculp.$	0.193	0.033	0.000
t_6	0.081	0.020	0.000	$photo$	-0.486	0.062	0.000
$share_t$	-0.986	0.116	0.000	$paint.$	0.123	0.019	0.000
k	9.553	0.020	0.000	$public$	-0.238	0.016	0.000
Obs.	25197						

R^2_{adj}	0.231

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $public$, $share_t$, t_2, t_3, t_4, t_5, t_6, $painting$, $drawing$, $sculpture$, $photography$, $graphics$, and $other\ genres$. Robust standard error are reported. All results are rounded at the third digit.

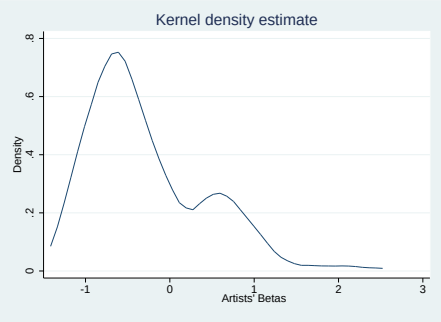


Figure 4.5: Distribution of artists' coefficients from model (4.4)

Given that the genre-related variables besides $other\ genres$ are all significantly different from 0, we check now if the pattern we observed is present also in the sub-samples of each genre. To do that, we estimate the following model in the four sub-samples of $painting$, $drawing$, $graphics$, and $sculpture$, without considering photography given that only 6 artists have more than 2 transactions concerning photography art, as well as $other\ genres$ because of its high heterogeneity:

$$ln(P_i) = k + \gamma_1 public + \gamma_2 share_t + \beta_j A_j + \tau_t I_{t,i} + \epsilon_i \quad (4.5)$$

Figure 4.6 contains the kernel density distributions of the coefficients for the art genre sub-samples; coefficients from paintings' sub-sample are in Panel 4.6a, drawings' are in Panel 4.6b,

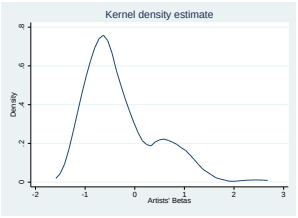
sculptures' in Panel 4.6c, while graphics' are in Panel 4.6d.[21] As one can see from the four graphs in Figure 4.6, the estimation of the OLS model in the sub-samples results in a bimodal distribution of the artists' coefficients for paintings, drawings, sculptures, and graphics. In particular, the first two panels (4.6a and 4.6b) present a distribution very similar to the one obtained from all the data, while sculptures (4.6c) have less difference in the density of the high and the low peaks. Graphics, instead, present a very accentuated bimodal form (4.6d). These differences between the four distributions are very likely due to the different behaviour the market has with respect to different art genres; in other words, it seems likely that drawings' and paintings' markets behave similarly, while sculptures' and graphics' present some particularities, even if the general pattern of bimodality is found also in these two markets. We present then the following claim.

Claim 4.2 *The art genre effect does not affect the bimodality and the scale of the peaks in the distribution of the artists' coefficients computed using the overall data. In the art genre sub-samples, the bimodality is robust, while the scale is robust only for paintings and for drawings.*

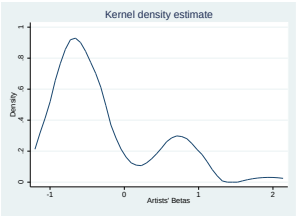
4.4.3 The year-by-year models

In order to check whether the bimodal distribution is a result of the aggregation of the 6 years of selling of our dataset, in this

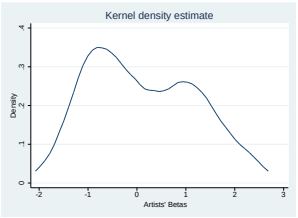
[21] Appendix B.2 contains the tables with the coefficients for the model in (4.5); the results for the observations for which $art\,genre_i = painting$ are reported in Table B.2.1, those for the artists who sold drawings are reported in Table B.2.2, Table B.2.3 contains sculptures' sub-sample results, and results for graphics are reported in Table B.2.4.



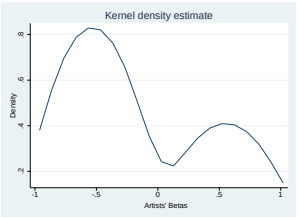
(a) Paintings



(b) Drawings



(c) Sculptures



(d) Graphics

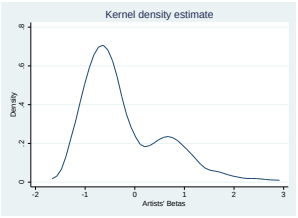
Figure 4.6: Genre-by-genre distribution of artists' coefficients from model (4.5)

Subsection we compute the OLS estimation of each year's subsample. The model we are going to estimate is the following:

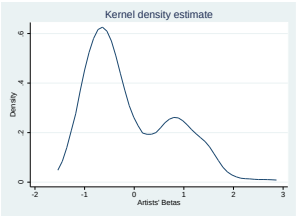
$$ln(P_i) = k + \gamma_1 public + \gamma_2 share_t + \gamma_3 art\,genre + \beta_j A_j + \epsilon_i \quad (4.6)$$

where $j = 1, ..., 230$, for i sold in year $t = 1, 2, ..., 6$.[22] As one can see from Figure 4.7, all the six years' coefficients present bimodal distributions, more similar to the benchmark model's one in year 1, 2, and 4. Year 3, 5, and 6 present some small peaks

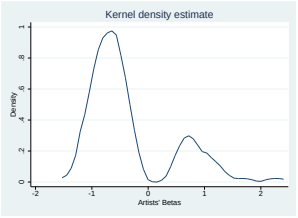
[22] As a robustness check, we also computed the model in (4.6) without $share_t$, without any changes in the results, that are not reported here but available upon request.



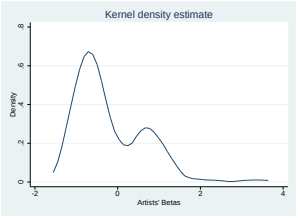
(a) Year 1



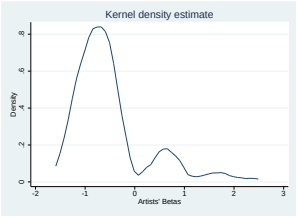
(b) Year 2



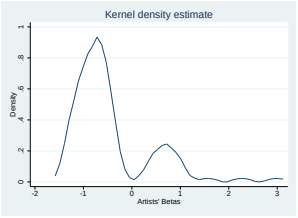
(c) Year 3



(d) Year 4



(e) Year 5



(f) Year 6

Figure 4.7: Year-by-year distribution of artists' coefficients from model (4.6)

after the second one, for values of the coefficient higher than 1, which may be due to particular behaviour of the market with respect to some artists in these years that could have reduced

the smoothness of the distribution.[23] We summarize this result in the following claim.

Claim 4.3 *There exists a year effect on the coefficients, as confirmed by the significance of some of the time dummies in the benchmark model, but it does not affect the form of the artists coefficients' distribution in each year.*

4.4.4 The price-effect model: Hedonic quantile regression

In this section we check if the pattern we found in the various specifications so far, the bimodality in the distribution of the artists' coefficients, is stable throughout the quantiles of the price distribution. The quantile hedonic model we will use is the following one:

$$\begin{aligned} Q_{ln(P)}(q|A, t, art\,genre, public, share_t) = k_q + \\ + \gamma_1 art\,genre + \gamma_2 public + \gamma_3 share_t + \\ + \beta_{qj} A_j + \tau_{q,t} I_{t,i} + \epsilon_{iq} \end{aligned} \tag{4.7}$$

where $j = 1, ..., 230$, $t = 2, ..., 6$, and $q = \{0.33, 0.5, 0.67\}$, that is, we compute the quantile regression for the first tertile, for the median, and for the second tertile; the results for the median are reported in Table 4.8.[24]

[23] Appendix B.3 contains the tables with the estimated coefficients for each of the six sub-samples. Results for year 1 are contained in Table B.3.1, year 2 results are reported in Table B.3.2, year 3 coefficients are in Table B.3.3, Table B.3.4 contains results from year 4 sub-sample, results from year 5 are reported in Table B.3.5, while year 6 results are reported in Table B.3.6. In Subsection 4.4.6 we shall check if the coefficients estimated in the benchmark model are statistically equal to those estimated from the six models from Equation (4.6).

[24] The results of the estimation considering the first and second tertiles are reported in Appendix B.4 in Table B.4.1 and B.4.2 respectively.

Table 4.8: Hedonic quantile model on overall data for $q = 0.5$

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.440	0.058	0.000	$A148$	-0.423	0.042	0.000
$A2$	0.575	0.072	0.000	$A149$	0.733	0.099	0.000
$A3$	1.175	0.217	0.000	$A150$	-0.178	0.022	0.000
$A4$	-0.825	0.037	0.000	$A151$	-0.694	0.057	0.000
$A6$	-0.912	0.062	0.000	$A152$	-0.673	0.071	0.000
$A7$	-0.737	0.070	0.000	$A153$	-0.750	0.058	0.000
$A8$	0.777	0.206	0.000	$A154$	-0.450	0.072	0.000
$A9$	-0.687	0.127	0.000	$A157$	0.218	0.124	0.079
$A10$	0.286	0.024	0.000	$A159$	-0.581	0.067	0.000
$A11$	-0.240	0.025	0.000	$A161$	-0.795	0.050	0.000
$A12$	-0.918	0.077	0.000	$A163$	0.672	0.052	0.000
$A13$	-0.579	0.021	0.000	$A164$	0.513	0.200	0.010
$A14$	-0.806	0.105	0.000	$A166$	-0.527	0.103	0.000
$A15$	0.515	0.111	0.000	$A167$	-0.693	0.078	0.000
$A16$	1.380	0.437	0.002	$A168$	-0.277	0.060	0.000
$A17$	0.736	0.196	0.000	$A169$	-0.316	0.063	0.000
$A18$	-0.611	0.166	0.000	$A170$	-0.329	0.104	0.002
$A20$	-0.539	0.014	0.000	$A171$	0.339	0.088	0.000
$A21$	0.243	0.117	0.038	$A172$	-0.782	0.097	0.000
$A22$	-0.162	0.081	0.046	$A175$	0.634	0.053	0.000
$A23$	-0.627	0.018	0.000	$A176$	-0.254	0.053	0.000
$A24$	-0.876	0.086	0.000	$A178$	0.652	0.128	0.000
$A25$	-0.127	0.057	0.025	$A179$	-0.823	0.093	0.000
$A26$	0.287	0.107	0.008	$A180$	-0.583	0.083	0.000
$A28$	-0.341	0.125	0.006	$A183$	1.693	0.188	0.000
$A100$	-0.583	0.057	0.000	$A185$	-0.252	0.079	0.001
$A101$	-0.739	0.036	0.000	$A186$	-0.476	0.232	0.040
$A103$	-0.401	0.073	0.000	$A187$	-0.762	0.049	0.000
$A104$	-0.459	0.058	0.000	$A188$	0.484	0.045	0.000
$A105$	-0.439	0.068	0.000	$A189$	-0.268	0.068	0.000
$A108$	1.073	0.050	0.000	$A190$	-0.713	0.080	0.000
$A109$	0.219	0.062	0.000	$A191$	-0.327	0.176	0.063
$A110$	-0.290	0.054	0.000	$A193$	-0.299	0.089	0.001
$A112$	2.363	1.354	0.081	$A198$	-0.321	0.115	0.005
$A113$	0.963	0.053	0.000	$A200$	-0.566	0.071	0.000
$A114$	-0.716	0.071	0.000	$A201$	-0.524	0.056	0.000
$A115$	-0.789	0.039	0.000	$A202$	-0.254	0.045	0.000
$A117$	0.575	0.081	0.000	$A204$	0.761	0.035	0.000
$A118$	-0.747	0.045	0.000	$A205$	0.424	0.112	0.000
$A120$	-0.316	0.055	0.000	$A206$	1.013	0.124	0.000
$A122$	-0.861	0.034	0.000	$A207$	-0.275	0.094	0.003
$A123$	-0.583	0.045	0.000	$A208$	-0.750	0.027	0.000
$A124$	-0.678	0.049	0.000	$A210$	-0.588	0.170	0.001

$A125$	0.170	0.021	0.000	$A211$	-0.468	0.086	0.000
$A127$	-0.604	0.112	0.000	$A212$	1.413	0.193	0.000
$A129$	-0.162	0.074	0.029	$A213$	1.115	0.118	0.000
$A130$	2.468	0.282	0.000	$A215$	-0.475	0.098	0.000
$A131$	-0.566	0.234	0.015	$A216$	-0.169	0.046	0.000
$A132$	-1.009	0.083	0.000	$A217$	0.792	0.154	0.000
$A134$	0.341	0.140	0.015	$A220$	-0.838	0.025	0.000
$A135$	1.481	0.244	0.000	$A221$	1.108	0.062	0.000
$A136$	1.011	0.034	0.000	$A222$	-0.629	0.020	0.000
$A139$	0.765	0.285	0.007	$A223$	0.725	0.073	0.000
$A140$	-0.287	0.161	0.075	$A224$	0.425	0.045	0.000
$A142$	-0.289	0.151	0.055	$A225$	-0.301	0.096	0.002
$A143$	1.336	0.109	0.000	$A226$	0.427	0.078	0.000
$A144$	-0.531	0.046	0.000	$A227$	0.286	0.046	0.000
$A145$	0.818	0.088	0.000	$A228$	0.307	0.044	0.000
$A146$	0.400	0.170	0.019	$A230$	0.541	0.168	0.001
$art\,gen$	0.057	0.004	0.000	t_2	0.043	0.012	0.000
$share_t$	-0.493	0.118	0.000	t_4	0.046	0.019	0.013
$public$	-0.281	0.016	0.000	t_6	0.069	0.017	0.000
k	9.107	0.022	0.000				
Obs.	23862						

Notes: Quantile regression for $q = 0.50$. Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_t$, t_2, t_3, t_4, t_5, t_6. Robust standard error are reported. All results are rounded at the third digit.

Also in this estimation we implemented the quantile regression using a stepwise regression approach with the significance level at 0.10. The estimated artists' coefficients for the 0.50 quantile are 118 and lay in a range that goes from -1.01 to 2.47, not too different from the range of the benchmark model results. The other covariates have all significant coefficients, with the same sign they had in the benchmark model estimation as in Table 4.6 and 4.7. The coefficients for the time dummies are significant, again, only for even years (2008, 2010, 2012), as in the other specifications.[25]

[25] As a robustness check, we also computed the quantile regression of the model in (4.7) dropping the variable $share_t$, finding similar results; the resulting coefficients and their distribution are not reported here but are available upon request.

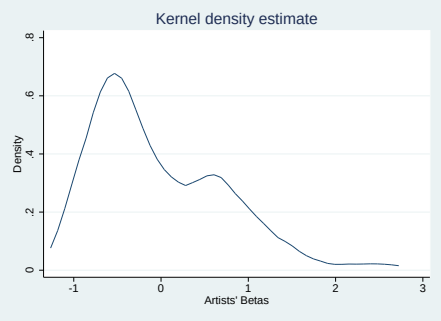
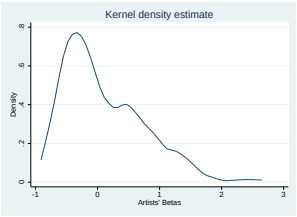
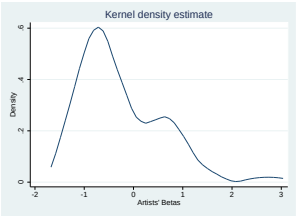


Figure 4.8: Distribution of artists' coefficients from model (4.7) for $q = 0.50$



(a) $q = 0.33$



(b) $q = 0.33$

Figure 4.9: Distribution of artists' coefficients from model (4.7) for $q = 0.33, 0.67$

The kernel distribution of the coefficients for the median is reported in Figure 4.8, and presents a bimodal form. Figure 4.9 contains the kernel distributions for $q = 0.33$ and $q = 0.67$, and both present a bimodal distribution as well, even if in Panel 4.9a it is less pronounced and in Panel 4.9b the distribution has also a small third peak after the second one; these particular deviations from the form of most of the other results may be

due to the fact that only some artists belong to certain level of price. This allows us to present the following claim.

Claim 4.4 *There exists a price effect on the coefficients that affects the estimation of some of the indices. This effect slightly affects also the distribution scale of the coefficients, without changing its bimodal form.*

4.4.5 The year-by-year price-effect models

In order to answer to a similar question to the one we asked in Subsection 4.4.3, we compute the quantile hedonic regression in all the 6 sub-samples given by the artworks sold in each year. The model we use is the following:

$$\begin{aligned} Q_{ln(P)}(q|A,t,art\,genre,public,share_t) = k_{q,t} + \\ + \gamma_{1,q,t} art\,genre + \gamma_{2,q,t} public + \\ + \gamma_{3,q,t} share_t + \beta_{q,j,t} A_j + \epsilon_{i,q,t} \end{aligned} \tag{4.8}$$

with $j = 1, ..., 230$, $q = 0.50$, and $t = 1, ..., 6$ that defines the six sub-samples.[26] Figure 4.10 reports the 6 years' coefficients kernel distributions. As one can see, the first two years (Panels 4.10a and 4.10b) and year 5 (Panel 4.10e present a bimodal form which is slightly different form the one of the benchmark model distribution, while the other years' distributions (Pan-

[26]The results of the estimation of the 6 models are reported in Appendix B.5. Results for year 1 are reported in Tables B.5.1, year 2's are in Table B.5.2, year 3's in Table B.5.3, year 4's in Table B.5.4, year 5's in Table B.5.5, and year 6's in Table B.5.6. Notice that, since the standard backward quantile regression reported some issues in the computation for year 4 and 5, we implemented the quantile regression using a bootstrap technique for these 2 years, and then dropping all the non significantly different from 0 coefficients. As a robustness check, we implemented the model in (4.8) for each year also dropping the variable $share_t$, without significant changes in the results, which are not reported here but available upon request.

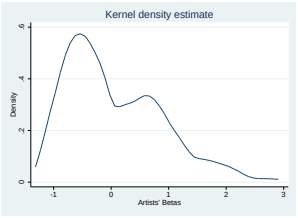
els 4.10c, 4.10d, and 4.10f) are similar to the benchmark model distribution. We can present then the following claim.

Claim 4.5 *The price effect together with the year effect does not affect the bimodal form of the artists coefficients' distribution. The scale is not affected for year 3, year 4, and year 6 coefficients.*

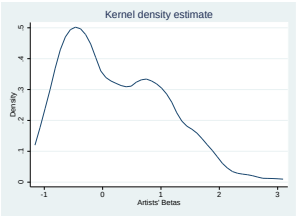
4.4.6 Analysis of artists' coefficients dynamics and ranking

Can we use a unique coefficient in a certain temporal span to create an index of value of an artist? Or is it better to analyse year-by-year her behaviour in the market, since the market may be unstable and unpredictable (Baumol, 1986)? And, does the value of an artist in the market remain stable independently on the price of her artworks? Or is the value varying depending on the level of price? In this subsection we attempt to answer to these questions inspecting the year-by-year and the price quantile-by-price quantile dynamics of the coefficients for a certain artist, comparing it with the benchmark model coefficient.

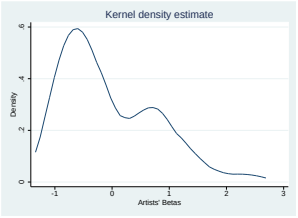
Starting with the time-related questions, we first analyzed graphically the dynamics of the coefficients overtime, comparing it with the benchmark model coefficients. Recall that we added the year dummies in our benchmark model (as in Equation 4.3), to account for the cycle and the behaviour of the art market in a certain year, so if there is some gap between the overall OLS and the year-by-year coefficients it is very likely due to an artist effect, a change in her value in the market. There are various possible dynamics that can be represented mainly by four patterns, given the combinations of high and



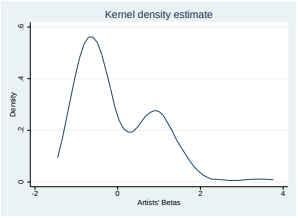
(a) Year 1



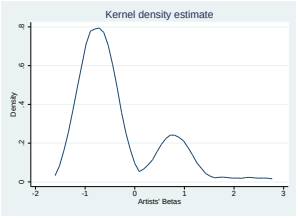
(b) Year 2



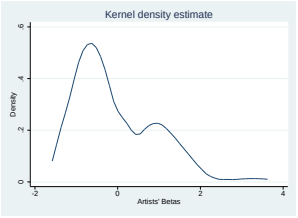
(c) Year 3



(d) Year 4



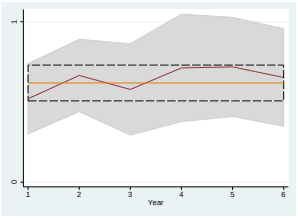
(e) Year 5



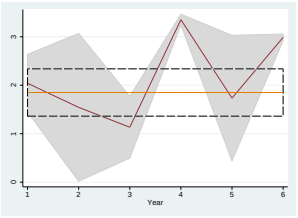
(f) Year 6

Figure 4.10: Year-by-year distribution of artists' coefficients from model (4.8) for $q = 0.50$

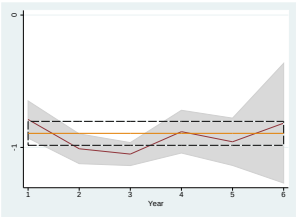
low value (above or below 0) and of stable and unstable evolution (stability is considered with respect to the benchmark model coefficient). Figure 4.11 represents the four combina-



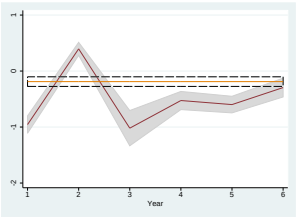
(a) $A223$



(b) $A112$



(c) $A187$



(d) $A128$

Figure 4.11: Year-by-year regressions and benchmark model coefficients

Notes: Year-by-year regression 0.90 confidence interval is in grey, benchmark model 0.90 confidence interval is dashed

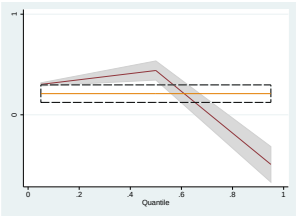
tions: for example, Emilio Vedova ($A223$) has a stable dynamics with a high value (Panel 4.11a), while Anish Kapoor ($A112$) has a high value as well, but presents instability of his coefficient overtime (Panel 4.11b). Similarly, Panel 4.11c contains Franco Rognoni's ($A187$) stable and low-value dynamics, while Renato Mambor ($A128$) has a low value and an overtime dynamics which is not stable (Panel 4.11d). Similarly to these four artists, the other artists can be classified depending on their stability

and their importance.[27]
Passing to a more quantitative analysis of the year-by-year dynamics, we compared the coefficients estimated through our benchmark model with those estimated using OLS regression on each of the years through a t-test. Among the 578 artists' coefficients estimated for both the overall and the year-by-year cases, 418 are statistically equal at a 95% significance, while 160 are not. In our case, then, if one uses the coefficients estimated without considering the year effect, he will incur in coefficients which are wrong on more than 25% of the cases. This leads us to our next claim.

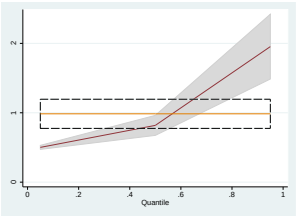
Claim 4.6 *The year-by-year dynamics of coefficients presents four different patterns of stability with respect to the OLS coefficient, that is, high-value artist with stable dynamics, high-value artist with unstable dynamics, low-value artist with stable dynamics, and low-value artist with unstable dynamics. Given the existence of this dynamics, computing coefficients for a temporal span without taking the year effect into account could lead to wrong estimates.*

Focusing on the questions related to the quantile regression coefficients, we apply a similar approach, starting to study the graphs of the benchmark model coefficient versus the quantile regression ones, computed for $q = 0.05, 0.50, 0.95$, so that we have a quantile-by-quantile dynamics. As for the year-by-year coefficients, we have various patterns; some of them are reported in Figure 4.12. Accardi Carla ($A1$), in Panel 4.12a, presents for example a coefficient higher than the OLS one and quite stable up to the median, that then decreases. Panel 4.12b, representing Giorgio Morandi's ($A145$) coefficients, presents a strongly increasing coefficient through the quantiles, while the

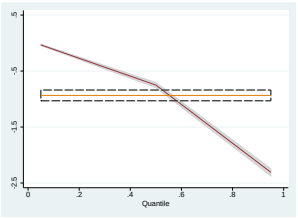
[27] For sake of space, we do not report all the artists' figures here.



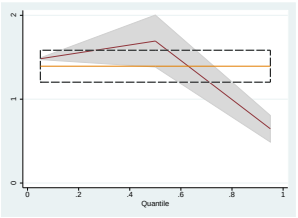
(a) $A1$



(b) $A145$



(c) $A208$



(d) $A183$

Figure 4.12: Quantile regressions and benchmark model coefficients

Notes: Quantile regression 0.90 confidence interval for $q = 0.05, 0.5, 0.95$ is in grey, benchmark model 0.90 confidence interval is dashed

quantile coefficients computed for Remo Squillantini ($A208$, in Panel 4.12c) are decreasing as the price of his works reaches higher quantiles of the distribution. Marc Quinn's ($A183$) dynamics, represented in Panel 4.12d, presents the coefficients up to the median which are not statistically different to the benchmark model's ones (at 0.90 confidence level), and then a decreasing coefficient. Differently from the year-by-year dynamics, the quantile-by-quantile dynamics is characterized by more patterns; however, the ones in Figure 4.12 are the most frequent

ones. Since not all the artists' coefficients present the same increasing or decreasing pattern, we could say that there exists a price effect on the coefficients, even if, as we saw in Subsections 4.4.4 and 4.4.5, this effect does not affect the coefficients distribution's bimodality. To further check for that, we computed a t-test to compare the benchmark model coefficients with the quantile regression coefficients, as we did above for the year-by-year dynamics. Among the 259 comparable coefficients, that is, coefficients available for both the OLS regression and the quantile regression, 64 (24.71%) present no statistical difference between the two estimation methods, while the other do, at a significance level of 95%. Among these 64 quantile regression coefficients statistically equal to the benchmark model's ones, 48 are obtained from the median regression, 8 from the quantile regression with $q = 0.95$, and 8 from the quantile regression with $q = 0.05$. In general, we can confirm that there exist a price effect that changes the coefficients in the various price quantile, as we hinted above analysing the graphs in Figure 4.12. We can present, then, our claim.

Claim 4.7 *The price quantile-by-price quantile dynamics of coefficients presents several different patterns, some of which are strictly increasing over price quantiles, other are statistically equal to OLS coefficient up to the median and then they become statistically different, while other are decreasing over price quantiles. Given the existence of a price effect, the index for all the levels of prices will likely be different from an index aimed to measure only the low-price artworks' artists.*

Given the robustness of the bimodality result we found, we can investigate if the estimated artists' coefficients in the various models generate different rankings. To do that, we report the ranking of the first 25 artists from the benchmark model

Table 4.9: Ranking of the first 25 artists in the benchmark model in the various models

Artist	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Manzoni Piero	1	1	1	1	1	2	1	5
Kapoor Anish	2	2	2	3	6	1	3	1
Quinn Marc	3	3	5	2	4	4	2	-
Tancredi	4	5	3	9	5	16	-	4
Mathieu Georges	5	4	6	15	2	8	14	15
Morandi Giorgio	6	15	12	4	-	19	4	8
Iras	7	6	-	20	10	-	5	3
Tayou Jean Appolinaire	8	9	4	6	11	23	10	17
Mitoraj Igor	9	7	7	13	19	11	8	11
Afro	10	8	9	8	18	14	7	13
Hartung Hans	11	11	15	16	3	10	16	9
Matta Roberto	12	13	10	21	24	7	-	-
Klein Yves	13	14	14	7	-	-	-	2
Vasarely Victor	14	10	8	12	8	21	-	-
Spalletti Ettore	15	12	24	5	13	-	17	7
Solakov Nedko	16	19	11	18	17	24	-	16
Vedova Emilio	17	22	22	22	22	20	9	14
Balla Giacomo	18	20	13	-	-	6	-	18
Appel Karel	19	17	18	-	7	9	6	-
Music Antonio Zoran	20	21	-	19	-	17	13	10
Pomodoro Arnaldo	21	24	17	-	-	18	12	-
Merz Mario	22	18	-	17	9	5	-	-
Lam Wifredo	23	-	19	-	14	-	-	-
Paladino Domenico	24	23	23	24	-	-	-	21
Tozzi Mario	25	16	-	-	12	-	11	22

Notes: Column 1 contains the ranking generated by model (4.3) (benchmark model), Column 2 the ranking generated from model in equation (4.7) with $q = 0.50$ (quantile regression on the median), Column 3 to 8 the rankings generated by the model in equation (4.6) from year 1 to year 6 respectively (year-by-year OLS regression).

and the rankings from models (4.7), and (4.6) for each of the 6 years.[28] As we can see from Table 4.9, the 25 best artists from

[28]We focused on the first 25 artists only for the sake of space. We also omitted

the benchmark model are not always included in the best 25 artists of the other rankings. For example, Marc Quinn is not present among the best 25 of the sixth year model, and Tancredi disappears from the year 5 model's best 25; again, Yves Klein is not present among the best 25 artists of the third, the fourth, and the fifth year models, while it gets to the second position in the sixth year's one. To take into account the sensibility of the ranking to the estimation model, one could create a super-index which weights all our measures, since all these aspects are relevant in the comparison of the individual characteristics of the artists, that is, fame and talent. We can summarize these results in the following claims.

Claim 4.8 *There exists a year effect which affects the ranking of the artists and it is independent on the cycle and on the behaviour of the art market in a given year.*

Claim 4.9 *There exists a price effect that affects the artists' coefficients ranking, and implies that the benchmark coefficients may not be the right ones to describe artists who sell low-price artworks.*

4.5 Conclusions

Starting from the construction of a benchmark model based on hedonic OLS regression, we build a novel index to account for the individual characteristics of the artists in the art market, that is, fame and talent, which allows us to rank them and to analyze the form of the distribution of the individual indices. This is done by using a unique hand-collected dataset on all

from Table 4.9 the ranking obtained from model (4.4) since it is equal to the benchmark's one.

the privately and publicly sold artworks in the Italian art market, between 2007 and 2012; the data are taken from the public SIAE database, which includes all the selling intermediated by a gallery or an auction house. The coefficients obtained from this first model present a strong bimodal distribution, with a higher peak for low levels of the index and a low peak for high levels (Claim 4.1). This pattern can be found also on other works on art markets (Chanel et al., 1996; Georges and Seçkin, 2013; Pradier et al., 2016), as well as in the ArtFacts.net index based on international auction prices; the bimodality result, moreover, is confirmed also for sub-samples of public prices only and private prices only. An interesting further extension of this research's results could be to consider the two peaks as the peaks of two different distributions and, then, to study the part of overlapping among these two as the artists who are moving from one population to the other: this could happen from the high-famed to the low-famed population and viceversa, and a time series analysis could help us understand this dynamics.

To answer to the question if and how the distribution of the coefficients changes with respect to time and genre, we modify the benchmark model through considering data sub-samples of each year and of each genre. We find that the bimodality and the scale of the peaks results are robust to these modifications (Claims 4.2 and 4.3). A time effect exists since all the even-year dummies are positive and significant different from zero in both the benchmark model and the art genres' model on overall data, as if there exists an economic cycle that lasts two year and has a positive peak on even years (2008, 2010, and 2012).

The hedonic quantile regression that we perform allows us to check for price effects on the behaviour of the artists' indices; in particular, we find that the price effect exists and affects some of the coefficients but it does not affect the bimodality of the distributions, even if the scale of the two peaks slightly changes (Claim 4.4). Considering the price effect together with the year effect, this modification of the scale of the two peaks is less pronounced (Claim 4.5).
A potential interpretation of the bimodality result we find in all our specifications of the model is related to the superstar theory, since our results always present two peaks in the distribution of the coefficients, a higher one in correspondence of low levels of the index (non-superstars) and a lower one for high levels of the index (superstars). However, a theory of fame formation which would result in this particular form of the distribution has not yet been developed in literature.

There are common results shared between all the models on overall data, that is, both $share_t$ and $public$ present a negative sign; the negative sign of the share could be due to a scale effect of the bigger intermediaries, since they sell more artworks and then they can sell at a lower price; the negative sign of $public$ could depend on the market power of the intermediaries in the market, which is different in the public market and in the private one.

We also analyze more in-depth the behaviour of the coefficients as the considered year changes, as well as the price quantile changes, and we find some regularity for these two dynamics. In particular, coefficients either are stable or unstable for what concerns the time dynamics (Claim 4.6), while quantile dynamics presents more patterns, for example increasing, de-

creasing, or first stable and then decreasing (Claim 4.7). This implies that the use of time dummies in the construction of the indices is not enough to overcome the year-by-year variation in the coefficients, since it is likely due to an artist-specific variation; similarly, the existence of the price dynamics in the coefficients signals that the use of a ranking based on all the prices is not efficient in ranking the low-price artists. Therefore, these dynamics of the coefficients have a significative effect on the ranking of the artists; in particular, we find that the ranking is sensitive to the year effect and the price effect (Claims 4.8 and 4.9), and hence the construction of a super-index as weighted average of the indices we present could be an improvement of the way the artists are ranked. Finally, further research could investigate if some particular artists' characteristics affects the behaviour of their coefficients in these dynamics; for example, a time variant characteristic could affect the time dynamics.

Appendix A

Proofs of Lemmas and Propositions in Chapter 2

A.1 Proof of Lemma 2.1

The gallery will buy the artwork from the insider or directly from the artist, depending if the gallery is in the $aigo/aigh$ channel or in the ago/agh channel. In any case, once the gallery has bought the artwork, it can decide to sell it to the outsider or to the auction house. We are going to demonstrate here that, whatever the price the gallery paid to buy the artwork, it will be sold to the auction house if (2.30) holds.
The proof is divided in four parts.

Proof. Assume the gallery received the artwork from the insider, paying a price equal to P^{ig}_{aigo}, as it is in equation (2.18),

and it can choose to sell it to the outsider or to the auction house. If the artwork is sold to the outsider, the price will be equal to (2.8), while if it will be sold to the auction house, in some sense "deviating" from the channel the insider considered when he bargained the price with the gallery, the price will be:

$$P^{gh}_{aigh}|P^{ig}_{aigo} = (1-\nu)P^{ig}_{aigo} + \nu P^{o}_{R} \tag{A.1}$$

where $P^{gh}_{aigh}|P^{ig}_{aigo}$ indicates that the gallery sells the artwork to the auction house also if it has been bought from the insider as if he thought it will be sold to the outsider.
Equation (2.8), considering the form of (2.18) and of (2.24) (the price paid by the insider to the artist), can be rewritten as:

$$P^{go}_{aigo} = \frac{(1-\delta)(1-\alpha)(1-\gamma)P^{a}_{R} + \delta\left[1-\alpha(1-\gamma)\right]P^{o}_{R}}{1-\alpha(1-\gamma)-\gamma(1-\delta)} \tag{A.2}$$

The price in (A.1) can be rewritten (using (2.18) and (A.2)) as:

$$\begin{aligned} &P^{gh}_{aigh}|P^{ig}_{aigo} = \\ &= \frac{(1-\nu)(1-\alpha)(1-\gamma)P^{a}_{R} + \nu\left[1-\alpha(1-\gamma)\right]P^{o}_{R}}{1-\alpha(1-\gamma)} + \\ &+ \frac{\gamma(1-\nu)}{1-\alpha(1-\gamma)}\left[\frac{(1-\delta)(1-\alpha)(1-\gamma)P^{a}_{R} + \delta\left[1-\alpha(1-\gamma)\right]P^{o}_{R}}{1-\alpha(1-\gamma)-\gamma(1-\delta)}\right] \end{aligned} \tag{A.3}$$

Selling the artwork to the auction house instead of selling it to the outsider, that is $aigh \succ aigo$, is the preferred choice if the price obtained from the auction house will be higher than the one obtained from the outsider, that is $P^{gh}_{aigh}|P^{ig}_{aigo} > P^{go}_{aigo}$. This is solved for:

$$\nu > \delta \tag{A.4}$$

For what concerns the "only if"-part of the relation, it is easy to proof, since $P^{gh}_{aigh}|P^{ig}_{aigo} > P^{go}_{aigo}$ and $\nu > \delta$ are equivalent, and $aigh \succ aigo$ implies that the price obtained in the $aigh$ channel thanks to the "deviation" is higher than the one obtained from the $aigo$ channel.
This concludes the first part of the proof.

Assume now that the gallery receives the artwork from the insider given that he thinks the gallery will sell the artwork to the auction house after that, so that the gallery pays the price as it is in equation (2.17). If the gallery sells the artwork to the auction house, as expected by the insider, the price it receives will be the one in (2.6); if, instead, the gallery "deviates" from what the insider expected, the price that the outsider pays will be:

$$P^{go}_{aigo}|P^{ig}_{aigh} = (1-\delta)P^{ig}_{aigh} + \delta P^{o}_{R} \tag{A.5}$$

The intuition behind the notation of the left-hand side of (A.5) is the same explained above for (A.1).
Considering the price paid by the insider in (2.23) together with (2.17), we can rewrite (2.6) as:

$$P^{gh}_{aigh} = \frac{(1-\nu)(1-\alpha)(1-\gamma)P^{a}_{R} + \nu\left[1-\alpha(1-\gamma)\right]P^{o}_{R}}{1-\alpha(1-\gamma)-\gamma(1-\nu)} \tag{A.6}$$

Using (A.6) together with (2.23) and (2.17), we can rewrite (A.5) as:

$$P^{go}_{aigo}|P^{ig}_{aigh} = \frac{(1-\delta)(1-\alpha)(1-\gamma)P^{a}_{R} + \delta\left[1-\alpha(1-\gamma)\right]P^{o}_{R}}{1-\alpha(1-\gamma)} + \\ + \frac{\gamma(1-\delta)}{1-\alpha(1-\gamma)}\left[\frac{(1-\nu)(1-\alpha)(1-\gamma)P^{a}_{R} + \nu\left[1-\alpha(1-\gamma)\right]P^{o}_{R}}{1-\alpha(1-\gamma)-\gamma(1-\nu)}\right] \tag{A.7}$$

Thus, $aigh \succ aigo$ can be rewritten using the prices in (A.6) and in (A.7) as $P^{gh}_{aigh} > P^{go}_{aigo}|P^{ig}_{aigh}$, that is solved for:

$$\nu > \delta \tag{A.8}$$

The "only if"-part of the relation is again easy to proof, since the relation $aigh \succ aigo$ implies $P^{gh}_{aigh} > P^{go}_{aigo}|P^{ig}_{aigh}$, which is equivalent to (A.8).
This concludes the second part of the proof.

Assume now that, being on the ago/agh channel, the gallery buys the artwork from the artist at a price equal to the one in (2.29), that is, the one that is the result of the bargaining between the artist and the gallery when the artist thinks that the gallery will sell the artwork to the outsider afterward. If the gallery really sells the artwork to the outsider, the price will be equal to the one in (2.12). If, instead, the gallery sells it to the auction house, "deviating" from what the artist thought, the price will be equal to:

$$P^{gh}_{agh}|P^{ag}_{ago} = (1-\nu)P^{ag}_{ago} + \nu P^{o}_{R} \tag{A.9}$$

Substituting (2.29), (2.12) can be rewritten as:

$$P^{go}_{ago} = \frac{(1-\delta)(1-\beta)P^{a}_{R} + \delta P^{o}_{R}}{1-\beta(1-\delta)} \tag{A.10}$$

Substituting (A.10) and (2.29) in (A.9), we get:

$$P^{gh}_{agh}|P^{ag}_{ago} = \frac{(1-\nu)(1-\beta)P^{a}_{R} + [\beta(\delta-\nu)+\nu]\,P^{o}_{R}}{1-\beta(1-\delta)} \tag{A.11}$$

The gallery will prefer to sell to the auction house ($agh \succ ago$) if the price obtained in this case will be higher, that is, using

(A.10) and (A.11), if $P^{gh}_{agh}|P^{ag}_{ago} > P^{go}_{ago}$, which is solved for:

$$\nu > \delta \tag{A.12}$$

The "only if" part of the relation is again straightforward to proof, since $\nu > \delta$ is equivalent to $P^{gh}_{agh}|P^{ag}_{ago} > P^{go}_{ago}$, and the former expression is true if $agh \succ ago$.
This concludes the third part of the proof.

Assume that the gallery pays the artwork at a price bargained with the artist as if she thinks the gallery will sell the artwork to the auction house afterward, that is, at (2.28). If the gallery will sell the artwork to the auction house, the price it will get is the one in (2.10); if, instead, the gallery sells the artwork to the outsider, the price will be equal to:

$$P^{go}_{ago}|P^{ag}_{agh} = (1-\delta)P^{ag}_{agh} + \delta P^{o}_{R} \tag{A.13}$$

Substituting (2.28) in (2.10), we get:

$$P^{gh}_{agh} = \frac{(1-\nu)(1-\beta)P^{a}_{R} + \nu P^{o}_{R}}{1-\beta(1-\nu)} \tag{A.14}$$

Substituting (A.14) and (2.28) into (A.13), we obtain:

$$P^{go}_{ago}|P^{ag}_{agh} = \frac{(1-\delta)(1-\beta)P^{a}_{R} + [\beta(\nu-\delta)+\delta]\,P^{o}_{R}}{1-\beta(1-\nu)} \tag{A.15}$$

The gallery will prefer to sell to the auction house ($agh \succ ago$) if the price it will obtain will be higher, that is, using (A.14) and (A.15), if $P^{gh}_{agh} > P^{go}_{ago}|P^{ag}_{agh}$, that is solved for:

$$\nu > \delta \tag{A.16}$$

The "only if"-part of the relation is straightforward to proof, since (A.16) is equivalent to $P^{gh}_{agh} > P^{go}_{ago}|P^{ag}_{agh}$, and this last expression is implied by $agh \succ ago$.
This completes the proof. ■

A.2 Proof of Lemma 2.2

Similarly to what we saw in Appendix A.1, we demonstrate here that the gallery will sell to the outsider after having bought the artwork from either the artist or the gallery independently on the price paid if (2.31) holds. Also this proof is made up of 4 parts.

Proof. Assume the gallery bought the artwork from the insider paying a price equal to P^{ig}_{aigo}, that is, having that the insider thought that the gallery will sell it to the outsider afterwards. If the gallery sells it to the outsider, the price will be P^{go}_{aigo}, as in (A.2), while if it sells the artwork to the auction house, the price will be the one in (A.3). Comparing these two prices, selling to the outsider will be preferred to selling to the auction house ($aigo \succ aigh$) when $P^{go}_{aigo} > P^{gh}_{aigh}|P^{ig}_{aigo}$, and this is equivalent to:

$$\delta > \nu \tag{A.17}$$

This completes the first part of the proof.

Assume now that the gallery received the artwork from the insider, by paying P^{ig}_{aigh}, since the insider thought he was on the $aigh$ channel. If the gallery sells the artwork to the auction house as thought by the insider, the price will be P^{gh}_{aigh}, as in (A.6), while if it "deviates" and sells it to the outsider, the price

will be the one in (A.7). For the gallery, $aigo \succ aigh$ is equivalent to $P^{go}_{aigo}|P^{ig}_{aigh} > P^{gh}_{aigh}$, which is solved for:

$$\delta > \nu \tag{A.18}$$

This completes the second part of the proof.

Assume, finally, that the gallery bought the artwork from the artist, paying P^{ag}_{ago}, that is, paying a bargaining price that is the result of the bargaining between the gallery and the artist when she thinks the gallery will sell the artwork to the outsider afterwards. If the gallery sells the artwork to the outsider, the price it receives will be equal to (A.10), while if it sells the artwork to the auction house, the price will be equal to the one in (A.11). The gallery will sell the artwork to the outsider if $ago \succ agh$, which is equivalent to $P^{go}_{ago} > P^{gh}_{agh}|P^{ag}_{ago}$, which is solved for:

$$\delta > \nu \tag{A.19}$$

This completes the third part of the proof.

Assume now that the gallery bought the artwork from the artist, paying P^{ag}_{agh}; the price is the solution of the bargaining between the gallery and the artist when the latter thinks that the gallery will sell the artwork to the auction house afterwards. If the gallery actually sells the artwork to the auction house, the price will be the one in (A.14), while if it "deviates" and sells it to the outsider, the price will be (A.15). The gallery will prefer selling the artwork to the outsider if $ago \succ agh$, that is, if $P^{go}_{ago}|P^{ag}_{agh} > P^{gh}_{agh}$, which is solved for:

$$\delta > \nu \tag{A.20}$$

This completes the proof. ■

A.3 Proof of Lemma 2.3

We now demonstrate that, independently on what is the price paid by the insider, that is, independently on what the artist thinks about the channel the artwork will take, he will sell the artwork to the auction house if and only if condition in (2.32) holds, given that (2.30) holds by assumption. The proof is made up of two parts.

Proof. Assume the insider paid P^{ai}_{aih} for the artwork, since the artist thought he would have sold it to the auction house afterwards. If the insider actually sells the artwork to the auction house, he will receive a price equal to P^{ih}_{aih}, as it is in (2.14), that, considering also the form of P^{ai}_{aih} as it is in (2.25), can be rewritten as:

$$P^{ih}_{aih} = \frac{(1-\mu)(1-\alpha)P^a_R + \mu P^o_R}{1-\alpha(1-\mu)} \tag{A.21}$$

If, instead, the insider sells the artwork to the gallery, knowing that the gallery will sell the artwork to the auction house (given that (2.30) holds by assumption), he will get a price equal to $P^{ig}_{aigh}|P^{ai}_{aih}$, which will be equal to:

$$P^{ig}_{aigh}|P^{ai}_{aih} = (1-\gamma)P^{ai}_{aih} + \gamma P^{gh}_{aigh}|P^{ai}_{aih} \tag{A.22}$$

where $P^{gh}_{aigh}|P^{ai}_{aih} = (1-\nu)P^{ig}_{aigh}|P^{ai}_{aih} + \nu P^o_R$. Using (2.25) and

(A.21), we can rewrite (A.22) as:

$$P^{ig}_{aigh}|P^{ai}_{aih} = \frac{(1-\gamma)(1-\alpha)P^a_R + \alpha\mu(1-\gamma)P^o_R}{[1-\gamma(1-\nu)]\,[1-\alpha(1-\mu)]} + \frac{\gamma\nu P^o_R}{1-\gamma(1-\nu)} \tag{A.23}$$

The insider will prefer to sell the artwork to the auction house ($aih \succ aigh$) when the price in (A.21) is greater than the one in (A.23), that is, when $\mu > \frac{\gamma\nu}{1-\gamma(1-\nu)}$. This completes the first half of the proof.

Assume now that the insider paid P^{ai}_{aigh} to buy the artwork: if he sells the artwork to the gallery as expected by the artist (and, afterwards, the gallery will sell the artwork to the auction house, given that (2.30) holds), he will get P^{ig}_{aigh}, which, using (2.17) together with (2.6) and (2.23), has the following form:

$$P^{ig}_{aigh} = \frac{(1-\gamma)(1-\alpha)P^a_R + \gamma\nu P^o_R}{1-\alpha(1-\gamma)-\gamma(1-\nu)} \tag{A.24}$$

Instead, if the insider sells the artwork to the auction house directly, he will get $P^{ih}_{aih}|P^{ai}_{aigh} = (1-\mu)P^{ai}_{aigh} + \mu P^o_R$, which, using (A.24) and (2.23), can be rewritten as:

$$\begin{aligned} &P^{ih}_{aih}|P^{ai}_{aigh} = \mu P^o_R + \\ &+ \frac{(1-\mu)(1-\alpha)\,[1-\gamma(1-\nu)]\,P^a_R + \alpha\gamma\nu(1-\mu)P^o_R}{1-\alpha(1-\gamma)-\gamma(1-\nu)} \end{aligned} \tag{A.25}$$

The insider will prefer to sell the artwork directly to the auction house ($aih \succ aigh$) when the price in (A.25) is greater than the one in (A.24); this is equivalent to have the condition in (2.32) to hold. This completes the proof. ■

A.4 Proof of Lemma 2.4

We now demonstrate that the insider will sell the artwork to the gallery (that will sell the artwork to the auction house afterwards, for what Lemma 2.2 postulates when condition in (2.30) holds) independently on what is the price he paid for it if and only if (2.33) holds. The proof is made up of two parts.

Proof. Assume that the insider bought the artwork at a price equal to P_{aih}^{ai} from the artist; if he sells the artwork to the auction house as expected by the artist, he will receive a price equal to P_{aih}^{ih}, as it is in (A.21); if, instead, he will sell the artwork to the gallery, he will get $P_{aigh}^{gh}|P_{aih}^{ai}$, as it is in (A.23). The insider will prefer to sell the artwork to the gallery ($aigh \succ aih$) when (A.23) is greater than (A.21), which is equivalent to have (2.33) to hold. This completes the first part of the proof.

Assume instead that the insider bought the artwork paying P_{aigh}^{ai} from the artist; if he sells the artwork to the gallery, he will obtain a price equal to the one in (A.24), while if he sells it to the auction house, "deviating" from what the artists expects, he will obtain $P_{aih}^{ih}|P_{aigh}^{ai}$, as it is in (A.25). He will prefer to sell the artwork to the gallery ($aigh \succ aih$) if the first of these two prices is larger than the second one, that is, when (2.33) holds. This completes the proof. ■

A.5 Proof of Lemma 2.5

We demonstrate here that, under (2.31), the insider will sell the artwork to the auction house instead of to the gallery (knowing

that it will sell the artwork to the outsider afterwards, for what we said in Lemma 2.2 when (2.31) holds), independently on the price he paid to buy the artwork, if and only if (2.34) holds. The proof consists in two parts.

Proof. Assume that the insider bought the artwork from the artist paying P^{ai}_{aih}; if he sells the artwork to the auction house as expected by the artist, he will get P^{ih}_{aih} as it is in (A.21), while if he sells the artwork to the gallery (that, then, will sell the artwork to the outsider), he will get $P^{ig}_{aigo}|P^{ai}_{aih} = (1-\gamma)P^{ai}_{aih} + \gamma P^{go}_{aigo}|P^{ai}_{aih}$, where $P^{go}_{aigo}|P^{ai}_{aih} = (1-\delta)P^{ig}_{aigo}|P^{ai}_{aih} + \delta P^{o}_{R}$. Using (2.25) and (A.21), we have:

$$\begin{aligned} &P^{ig}_{aigo}|P^{ai}_{aih} = \\ &= \frac{(1-\gamma)(1-\alpha)P^{a}_{R} + \alpha\mu(1-\gamma)P^{o}_{R}}{[1-\gamma(1-\delta)]\,[1-\alpha(1-\mu)]} + \frac{\gamma\delta P^{o}_{R}}{1-\gamma(1-\delta)} \end{aligned} \tag{A.26}$$

The insider will prefer to sell the artwork to the auction house instead of to the gallery ($aih \succ aigo$) when the price in (A.21) is greater than the one in (A.26), and this is equivalent to have (2.34) to hold. This completes the first part of the proof.

Assuming now that the insider bought the artwork paying P^{ai}_{aigo}; if he actually sells the artwork to the gallery as expected by the artist, he will get P^{ig}_{aigo}, which, considering the form in (2.18) together with (2.8) and (2.24), will be equal to:

$$P^{ig}_{aigo} = \frac{(1-\gamma)(1-\alpha)P^{a}_{R} + \gamma\delta P^{o}_{R}}{1-\alpha(1-\gamma)-\gamma(1-\delta)} \tag{A.27}$$

If, instead, the insider sells the artwork to the auction house deviating from what the artist thought, he will get $P^{ih}_{aih}|P^{ai}_{aigo} =$

$(1-\mu)P^{ai}_{aigo} + \mu P^{o}_{R}$, which, using (2.24) and (A.27), becomes:

$$P^{ih}_{aih}|P^{ai}_{aigo} = \mu P^{o}_{R} + \\ + \frac{(1-\mu)(1-\alpha)\left[1-\gamma(1-\delta)\right]P^{a}_{R} + \alpha\gamma\delta(1-\mu)P^{o}_{R}}{1-\alpha(1-\gamma)-\gamma(1-\delta)} \quad \text{(A.28)}$$

The insider will prefer to sell the artwork to the auction house ($aih \succ aigo$) when the price in (A.28) is greater than the one in (A.27), which is true when condition in (2.34) holds. This completes the proof. ■

A.6 Proof of Lemma 2.6

In this section, we demonstrate that, under (2.31), the insider will always sell the artwork to the gallery (that will sell the artwork to the outsider afterwards, given what we said in Lemma 2.2), independently on the price he paid to the artist to buy it, if and only if (2.35) holds. The proof is made up of two parts.

Proof. Assume the insider paid P^{ai}_{aih} to the artist; if he sells the artwork to the auction house, he will get P^{ih}_{aih} as it is in (A.21), while if he sells it to the gallery he will get $P^{ig}_{aigo}|P^{ai}_{aih}$, as it is in (A.26). He will prefer to sell the artwork to the outsider (that is, $aigo \succ aih$) when the price in (A.26) is higher than the one in (A.21), which is true when (2.35) holds. This completes the first half of the proof.

Assuming instead that the insider paid P^{ai}_{aigo} to buy the artwork. If he actually sells the artwork to the gallery, he will get P^{ig}_{aigo} as it is in (A.27), while if he "deviates" from what the artist thought and sells the artwork to the auction house, he

will obtain the price in (A.28). The insider will prefer the $aigo$ channel to the aih channel when the price in (A.27) is greater than the one in (A.28), which happens when (2.35) holds. This completes the proof. ■

A.7 Proof of Proposition 2.1

A.7.1 Proof of Proposition 2.1.1

Proof. To prove that the artist prefers selling her artwork to the insider instead of to the gallery and to the auction house, given Lemma 2.3, that is, given that conditions in (2.30) and (2.32) hold, we need the two prices the artist would get from selling the artwork to the gallery (knowing that it will be sold directly to the auction house afterwards) and to the auction house to be smaller than the one that she will get if she sells it to the insider (knowing that he will sell it to the auction house afterwards). This is represented in the following system of conditions (that contains also the two conditions we assume to hold in Proposition 2.1):

$$\begin{cases} \frac{(1-\alpha)P_R^a+\alpha\mu P_R^o}{1-\alpha(1-\mu)} > \frac{(1-\beta)P_R^a+\beta\nu P_R^o}{1-\beta(1-\nu)} \\ \frac{(1-\alpha)P_R^a+\alpha\mu P_R^o}{1-\alpha(1-\mu)} > (1-\eta)P_R^a + \eta P_R^o \\ \gamma\nu - \mu + \mu\gamma - \mu\gamma\nu < 0 \\ \nu > \delta \end{cases} \tag{A.29}$$

The system is solved for the conditions reported in (2.36). This completes the proof. ■

A.7.2 Proof of Proposition 2.1.2

Proof. Given Lemma 2.3, the artist will prefer to sell the artwork to the gallery (agh) instead of to the insider (aih) or to the auction house (ah) if the price she will get from the first one will be greater than the ones she could get from the other two potential buyers. This is analytically represented in the following system (in which also the two conditions coming from the Proposition are present):

$$\begin{cases} \frac{(1-\beta)P_R^a+\beta\nu P_R^o}{1-\beta(1-\nu)} > \frac{(1-\alpha)P_R^a+\alpha\mu P_R^o}{1-\alpha(1-\mu)} \\ \frac{(1-\beta)P_R^a+\beta\nu P_R^o}{1-\beta(1-\nu)} > (1-\eta)P_R^a + \eta P_R^o \\ \gamma\nu - \mu + \mu\gamma - \mu\gamma\nu < 0 \\ \nu > \delta \end{cases} \tag{A.30}$$

The system is solved for the values of the parameters reported in (2.37). This completes the proof. ■

A.7.3 Proof of Proposition 2.1.3

Proof. The artist will prefer to sell the artwork to the auction house directly instead of selling the artwork to the insider or to the gallery (that, given Lemma 2.3, can be written as $ah \succ aih \wedge ah \succ agh$) if the price she obtains from the first bargaining is greater than the one she may obtain from the other two. This is represented in the following system:

$$\begin{cases} (1-\eta)P_R^a + \eta P_R^o > \frac{(1-\alpha)P_R^a+\alpha\mu P_R^o}{1-\alpha(1-\mu)} \\ (1-\eta)P_R^a + \eta P_R^o > \frac{(1-\beta)P_R^a+\beta\nu P_R^o}{1-\beta(1-\nu)} \\ \gamma\nu - \mu + \mu\gamma - \mu\gamma\nu < 0 \\ \nu > \delta \end{cases} \tag{A.31}$$

The system above is equivalent to the conditions in (2.38). This completes the proof. ■

A.8 Proof of Proposition 2.2

A.8.1 Proof of Proposition 2.2.1

Proof. Given Lemma 2.4, the artist will prefer to sell the artwork to the insider (that, then, will sell the artwork to the gallery and it will end up to be sold to the auction house) instead of to the gallery (that will sell the artwork to the auction house) or to the auction house, that is, $aigh \succ agh \wedge aigh \succ ah$, when the price she obtains from the first bargaining is greater than the ones she may obtain from the other two, namely:

$$\begin{cases} \frac{(1-\alpha)[1-\gamma(1-\nu)]P_R^a+\alpha\gamma\nu P_R^o}{1-\gamma(1-\nu)-\alpha(1-\gamma)} > \frac{(1-\beta)P_R^a+\beta\nu P_R^o}{1-\beta(1-\nu)} \\ \frac{(1-\alpha)[1-\gamma(1-\nu)]P_R^a+\alpha\gamma\nu P_R^o}{1-\gamma(1-\nu)-\alpha(1-\gamma)} > (1-\eta)P_R^a+\eta P_R^o \\ \gamma\nu-\mu+\mu\gamma-\mu\gamma\nu>0 \\ \nu>\delta \end{cases} \tag{A.32}$$

The system above, which contains also the two conditions we assume in Proposition 2.2, is solved for the conditions reported in (2.39). This completes the proof. ■

A.8.2 Proof of Proposition 2.2.2

Proof. The artist will prefer to sell the artwork to the gallery (agh) instead of selling the artwork to the insider ($aigh$) or the auction house (ah), given Lemma 2.4, when the price she obtains in the bargaining with the gallery is the highest among all the three prices. Analytically, this is represented in the follow-

ing system:

$$\begin{cases} \frac{(1-\beta)P_R^a+\beta\nu P_R^o}{1-\beta(1-\nu)} > \frac{(1-\alpha)[1-\gamma(1-\nu)]P_R^a+\alpha\gamma\nu P_R^o}{1-\gamma(1-\nu)-\alpha(1-\gamma)} \\ \frac{(1-\beta)P_R^a+\beta\nu P_R^o}{1-\beta(1-\nu)} > (1-\eta)P_R^a+\eta P_R^o \\ \gamma\nu-\mu+\mu\gamma-\mu\gamma\nu>0 \\ \nu>\delta \end{cases} \tag{A.33}$$

The system is solved for the conditions in (2.40). This completes the proof. ■

A.8.3 Proof of Proposition 2.2.3

Proof. The artist will sell the artwork to the auction house instead of selling the artwork to the insider ($aigh$) or to the gallery (agh) when the price she obtains in the agh channel is higher than the one she may obtain in the other two channels. This is analytically equivalent to the following system, which considers also the conditions in (2.30) and in (2.33) (implied by Lemma 2.4):

$$\begin{cases} (1-\eta)P_R^a+\eta P_R^o > \frac{(1-\alpha)[1-\gamma(1-\nu)]P_R^a+\alpha\gamma\nu P_R^o}{1-\gamma(1-\nu)-\alpha(1-\gamma)} \\ (1-\eta)P_R^a+\eta P_R^o > \frac{(1-\beta)P_R^a+\beta\nu P_R^o}{1-\beta(1-\nu)} \\ \gamma\nu-\mu+\mu\gamma-\mu\gamma\nu>0 \\ \nu>\delta \end{cases} \tag{A.34}$$

The system is solved for the conditions we reported in (2.41). This completes the proof. ■

A.9 Proof of Proposition 2.3

A.9.1 Proof of Proposition 2.3.1

Proof. Given Lemma 2.5, the artist will prefer to sell the artwork to the insider (knowing that he will sell the artwork to the auction house afterwards) to sell it to the gallery (knowing that it will be sold to the outsider) or to the auction house ($aih \succ ago \wedge aih \succ ah$) when the price she obtains from the first bargaining is the highest among the three bargained prices. Analytically, this is equivalent to the following system:

$$\begin{cases} \frac{(1-\alpha)P_R^a+\alpha\mu P_R^o}{1-\alpha(1-\mu)} > \frac{(1-\beta)P_R^a+\beta\delta P_R^o}{1-\beta(1-\delta)} \\ \frac{(1-\alpha)P_R^a+\alpha\mu P_R^o}{1-\alpha(1-\mu)} > (1-\eta)P_R^a + \eta P_R^o \\ \gamma\delta - \mu + \mu\gamma - \mu\gamma\delta < 0 \\ \nu < \delta \end{cases} \tag{A.35}$$

The system is solved for the conditions we reported in (2.42). This completes the proof. ■

A.9.2 Proof of Proposition 2.3.2

Proof. Given Lemma 2.5, the artist will prefer to sell the artwork to the gallery instead of to the insider or to the auction house ($ago \succ aih \wedge ago \succ ah$) as long as the price she obtains from the bargaining with the gallery is higher than the one she may obtain from the bargaining with the other two potential

buyers. This is equivalent to the following system:

$$\begin{cases} \frac{(1-\beta)P_R^a+\beta\delta P_R^o}{1-\beta(1-\delta)} > \frac{(1-\alpha)P_R^a+\alpha\mu P_R^o}{1-\alpha(1-\mu)} \\ \frac{(1-\beta)P_R^a+\beta\delta P_R^o}{1-\beta(1-\delta)} > (1-\eta)P_R^a + \eta P_R^o \\ \gamma\delta - \mu + \mu\gamma - \mu\gamma\delta < 0 \\ \nu < \delta \end{cases} \tag{A.36}$$

The system is solved for the conditions in (2.43). This completes the proof. ■

A.9.3 Proof of Proposition 2.3.3

Proof. Given Lemma 2.5, the artist will prefer to sell the artwork to the auction house directly instead of selling the artwork indirectly to the auction house through the insider or to sell it to the gallery (that will sell the artwork to the outsider) when the price she obtains from the first bargaining is higher than the ones she may obtain from the other two. This is analytically represented by the following system:

$$\begin{cases} (1-\eta)P_R^a + \eta P_R^o > \frac{(1-\alpha)P_R^a+\alpha\mu P_R^o}{1-\alpha(1-\mu)} \\ (1-\eta)P_R^a + \eta P_R^o > \frac{(1-\beta)P_R^a+\beta\delta P_R^o}{1-\beta(1-\delta)} \\ \gamma\delta - \mu + \mu\gamma - \mu\gamma\delta < 0 \\ \nu < \delta \end{cases} \tag{A.37}$$

The system is solved for the condition in (2.44). This completes the proof. ■

A.10 Proof of Proposition 2.4

A.10.1 Proof of Proposition 2.4.1

Proof. Given Lemma 2.6, the artist will prefer to sell the artwork to the insider (that will sell the artwork to the gallery, which, in turn, will sell it to the outsider) to sell the artwork to the the gallery (that will sell it to the outsider) or to the auction house (that is, $aigo \succ ago \wedge aigo \succ ah$), when the price she obtains from the bargaining with the insider is the highest among the three prices. This is analytically represented by the following system:

$$\begin{cases} \frac{(1-\alpha)[1-\gamma(1-\delta)]P_R^a+\alpha\gamma\delta P_R^o}{1-\gamma(1-\delta)-\alpha(1-\gamma)} > \frac{(1-\beta)P_R^a+\beta\delta P_R^o}{1-\beta(1-\delta)} \\ \frac{(1-\alpha)[1-\gamma(1-\delta)]P_R^a+\alpha\gamma\delta P_R^o}{1-\gamma(1-\delta)-\alpha(1-\gamma)} > (1-\eta)P_R^a + \eta P_R^o \\ \gamma\delta - \mu + \mu\gamma - \mu\gamma\delta > 0 \\ \nu < \delta \end{cases} \tag{A.38}$$

The system is solved for the conditions in (2.45). This completes the proof. ■

A.10.2 Proof of Proposition 2.4.2

Proof. Given Lemma 2.6, the artist will sell the artwork to the gallery (ago) instead of selling the artwork to the insider ($aigo$) or to the auction house (ah) when the price she obtains from the bargaining with the gallery is higher than the ones she may obtain from the bargaining with each of the other two potential

buyers. This is equivalent to the following system:

$$\begin{cases} \frac{(1-\beta)P_R^a+\beta\delta P_R^o}{1-\beta(1-\delta)} > \frac{(1-\alpha)[1-\gamma(1-\delta)]P_R^a+\alpha\gamma\delta P_R^o}{1-\gamma(1-\delta)-\alpha(1-\gamma)} \\ \frac{(1-\beta)P_R^a+\beta\delta P_R^o}{1-\beta(1-\delta)} > (1-\eta)P_R^a+\eta P_R^o \\ \gamma\delta-\mu+\mu\gamma-\mu\gamma\delta>0 \\ \nu<\delta \end{cases} \tag{A.39}$$

The system above is solved for the conditions in (2.46). This completes the proof. ■

A.10.3 Proof of Proposition 2.4.3

Proof. Given Lemma 2.6, the artist will prefer to sell the artwork to the auction house instead of selling the artwork to the gallery or to the insider (that is, $ah \succ aigo \wedge ah \succ ago$) when the price she obtains from the bargaining with the auction house is higher than the other two prices she may obtain from the bargaining with the other potential buyers. Analytically, this is equivalent to the following system:

$$\begin{cases} (1-\eta)P_R^a+\eta P_R^o > \frac{(1-\alpha)[1-\gamma(1-\delta)]P_R^a+\alpha\gamma\delta P_R^o}{1-\gamma(1-\delta)-\alpha(1-\gamma)} \\ (1-\eta)P_R^a+\eta P_R^o > \frac{(1-\beta)P_R^a+\beta\delta P_R^o}{1-\beta(1-\delta)} \\ \gamma\delta-\mu+\mu\gamma-\mu\gamma\delta>0 \\ \nu<\delta \end{cases} \tag{A.40}$$

The system is solved for the conditions in (2.47). This completes the proof. ■

Appendix B

Supplementary material for Chapter 4

B.1 Artists' codes

Table B.1.1: Artists' names and codes used in the models

Artist	Code	Artist	Code
Accardi Carla	$A1$	Kounellis Jannis	$A116$
Adami Valerio	$A2$	Lam Wifredo	$A117$
Afro	$A3$	Licata Riccardo	$A118$
Ajmone Giuseppe	$A4$	Licini Osvaldo	$A119$
Alviani Getulio	$A5$	Lilloni Umberto	$A120$
Angeli Franco	$A6$	Lindstrom Bengt	$A121$
Annigoni Pietro	$A7$	Lodola Marco	$A122$
Appel Karel	$A8$	Lupo Alessandro	$A123$
Aricò Rodolfo	$A9$	Maccari Mino	$A124$
Arienti Stefano	$A10$	Maggi Cesare	$A125$
Arman Fernandez	$A11$	Magnelli Alberto	$A126$
Asveri Gianfranco	$A12$	Mainolfi Luigi	$A127$
Attardi Ugo	$A13$	Mambor Renato	$A128$
Aubertin Bernard	$A14$	Mangione Salvatore	$A129$
Baj Enrico	$A15$	Manzoni Piero	$A130$
Iras	$A16$	Manzù Giacomo	$A131$
Balla Giacomo	$A17$	Marchegiani Elio	$A132$
Barnils Sergi	$A18$	Marini Marino	$A133$

B.2 Results of the OLS estimation of the model in (4.5) in the sub-samples of the art genres

Table B.2.1: Hedonic regression on paintings sub-sample

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.211	0.054	0.000	$A152$	-0.914	0.043	0.000
$A2$	0.195	0.059	0.001	$A153$	-0.897	0.045	0.000
$A3$	1.076	0.100	0.000	$A154$	-0.767	0.066	0.000
$A4$	-1.048	0.051	0.000	$A155$	-0.218	0.096	0.023
$A5$	-0.155	0.073	0.034	$A156$	-0.412	0.061	0.000
$A6$	-0.907	0.073	0.000	$A158$	0.338	0.180	0.060
$A7$	-0.959	0.054	0.000	$A159$	-0.713	0.045	0.000
$A8$	0.605	0.169	0.000	$A160$	-0.389	0.215	0.071
$A9$	-0.753	0.123	0.000	$A161$	-0.984	0.054	0.000
$A10$	-0.229	0.116	0.049	$A163$	0.412	0.067	0.000
$A12$	-1.092	0.040	0.000	$A164$	0.394	0.163	0.016
$A13$	-0.822	0.071	0.000	$A165$	-0.385	0.099	0.000
$A14$	-0.999	0.066	0.000	$A166$	-0.658	0.128	0.000
$A15$	0.161	0.081	0.048	$A167$	-0.826	0.049	0.000
$A16$	1.035	0.167	0.000	$A168$	-0.403	0.047	0.000
$A17$	0.740	0.160	0.000	$A169$	-0.542	0.091	0.000
$A18$	-0.791	0.063	0.000	$A172$	-1.065	0.044	0.000
$A19$	-1.070	0.115	0.000	$A174$	-0.204	0.121	0.092
$A20$	-0.650	0.099	0.000	$A175$	-1.349	0.018	0.000
$A21$	-0.317	0.183	0.082	$A176$	-0.459	0.072	0.000
$A22$	-0.450	0.062	0.000	$A177$	-0.466	0.098	0.000
$A23$	-0.892	0.083	0.000	$A179$	-1.026	0.070	0.000
$A24$	-0.900	0.065	0.000	$A180$	-0.816	0.047	0.000
$A25$	-0.451	0.063	0.000	$A182$	-0.206	0.085	0.016
$A27$	-0.568	0.093	0.000	$A183$	1.375	0.114	0.000
$A28$	-0.591	0.060	0.000	$A184$	-0.219	0.132	0.096
$A100$	-0.793	0.043	0.000	$A185$	-0.360	0.095	0.000
$A101$	-0.907	0.033	0.000	$A186$	-0.730	0.085	0.000
$A103$	-0.602	0.092	0.000	$A187$	-0.897	0.055	0.000
$A104$	-0.736	0.065	0.000	$A188$	0.187	0.059	0.002
$A105$	-0.467	0.050	0.000	$A190$	-0.843	0.050	0.000
$A108$	0.836	0.082	0.000	$A191$	-0.584	0.085	0.000
$A110$	-0.694	0.081	0.000	$A193$	-0.400	0.068	0.000
$A111$	-0.369	0.117	0.002	$A194$	-0.207	0.045	0.000
$A113$	1.201	0.305	0.000	$A195$	0.202	0.106	0.056
$A114$	-0.870	0.119	0.000	$A197$	-0.322	0.099	0.001

$A115$	-0.978	0.030	0.000	$A198$	-0.267	0.121	0.027
$A117$	0.564	0.193	0.003	$A199$	0.653	0.197	0.001
$A118$	-0.906	0.040	0.000	$A200$	-0.658	0.080	0.000
$A119$	0.810	0.238	0.001	$A201$	-0.813	0.045	0.000
$A120$	-0.623	0.059	0.000	$A202$	-0.223	0.055	0.000
$A121$	-0.264	0.057	0.000	$A204$	0.445	0.155	0.004
$A122$	-1.172	0.058	0.000	$A206$	0.731	0.097	0.000
$A123$	-0.700	0.080	0.000	$A208$	-0.976	0.061	0.000
$A124$	-0.888	0.044	0.000	$A209$	-0.351	0.061	0.000
$A127$	-0.568	0.221	0.010	$A210$	-0.813	0.066	0.000
$A128$	-0.194	0.053	0.000	$A211$	-0.754	0.056	0.000
$A129$	-0.380	0.047	0.000	$A212$	1.086	0.125	0.000
$A130$	2.440	0.219	0.000	$A213$	0.881	0.107	0.000
$A131$	-0.903	0.133	0.000	$A214$	-0.492	0.102	0.000
$A132$	-1.138	0.092	0.000	$A215$	-0.568	0.105	0.000
$A135$	1.092	0.095	0.000	$A216$	-0.434	0.070	0.000
$A136$	0.833	0.147	0.000	$A217$	0.395	0.106	0.000
$A140$	-0.749	0.208	0.000	$A218$	-0.301	0.041	0.000
$A141$	-0.527	0.081	0.000	$A220$	-0.935	0.092	0.000
$A142$	0.877	0.420	0.037	$A221$	0.814	0.073	0.000
$A144$	-0.709	0.042	0.000	$A222$	-0.766	0.085	0.000
$A145$	1.479	0.162	0.000	$A223$	0.693	0.071	0.000
$A148$	-0.555	0.091	0.000	$A224$	0.132	0.051	0.010
$A149$	0.581	0.084	0.000	$A225$	-0.609	0.053	0.000
$A150$	-0.324	0.106	0.002	$A229$	-0.575	0.128	0.000
$A151$	-0.944	0.041	0.000	$A230$	0.273	0.104	0.009
$public$	-0.236	0.019	0.000	t_2	0.072	0.017	0.000
$share_t$	-0.956	0.132	0.000	t_4	0.061	0.020	0.002
k	9.634	0.016	0.000	t_6	0.104	0.023	0.000
Obs.	18744						
R^2_{adj}	0.231						

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $public$, $share_t$, t_2, t_3, t_4, t_5, t_6. Only observations for which $painting = 1$ have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

Table B.2.2: Hedonic regression on drawings sub-sample

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A3$	-0.196	0.116	0.090	$A167$	-0.223	0.045	0.000
$A6$	-0.937	0.045	0.000	$A168$	-0.410	0.130	0.002
$A7$	-0.638	0.319	0.046	$A170$	1.949	0.398	0.000
$A10$	0.551	0.045	0.000	$A173$	-0.612	0.131	0.000
$A16$	-0.861	0.046	0.000	$A175$	-0.470	0.246	0.057

$A25$	-1.015	0.104	0.000	$A176$	-0.715	0.175	0.000
$A26$	0.745	0.231	0.001	$A177$	0.724	0.226	0.001
$A106$	-0.458	0.115	0.000	$A178$	0.348	0.045	0.000
$A108$	0.785	0.141	0.000	$A181$	-0.797	0.077	0.000
$A110$	-0.803	0.045	0.000	$A183$	0.892	0.061	0.000
$A114$	-0.581	0.045	0.000	$A188$	-0.944	0.045	0.000
$A118$	-0.876	0.045	0.000	$A189$	-0.491	0.099	0.000
$A119$	-0.321	0.103	0.002	$A190$	0.545	0.045	0.000
$A129$	0.230	0.084	0.007	$A193$	-0.645	0.077	0.000
$A131$	-0.558	0.134	0.000	$A194$	0.884	0.068	0.000
$A133$	-0.560	0.121	0.000	$A195$	-0.363	0.089	0.000
$A134$	-0.633	0.065	0.000	$A202$	-0.245	0.100	0.015
$A137$	-0.969	0.046	0.000	$A203$	-0.969	0.046	0.000
$A138$	-0.628	0.118	0.000	$A204$	0.954	0.156	0.000
$A141$	-0.779	0.045	0.000	$A207$	-0.563	0.238	0.018
$A143$	0.901	0.056	0.000	$A209$	-0.164	0.075	0.030
$A145$	0.502	0.233	0.031	$A211$	-0.568	0.045	0.000
$A146$	-0.850	0.045	0.000	$A212$	-0.411	0.212	0.053
$A147$	-0.861	0.055	0.000	$A217$	-0.901	0.045	0.000
$A155$	-0.443	0.215	0.040	$A219$	-0.904	0.047	0.000
$A156$	-0.922	0.045	0.000	$A222$	0.827	0.045	0.000
$A157$	-0.369	0.045	0.000	$A223$	-0.205	0.112	0.067
$A158$	-0.888	0.157	0.000	$A225$	-0.582	0.045	0.000
$A163$	-0.695	0.134	0.000	$A226$	-0.587	0.192	0.002
$share_t$	5.643	1.433	0.000	t_6	0.292	0.108	0.007
k	9.061	0.045	0.000	$public$	-0.419	0.088	0.000
Obs.	666						
R^2_{adj}	0.279						

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $public$, $share_t$, t_2, t_3, t_4, t_5, t_6. Only observations for which $drawing = 1$ have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

Table B.2.3: Hedonic regression on sculptures sub-samples

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A11$	-0.363	0.057	0.000	$A148$	-1.087	0.187	0.000
$A13$	-0.365	0.085	0.000	$A149$	-0.356	0.057	0.000
$A14$	-1.486	0.283	0.000	$A152$	-1.415	0.064	0.000
$A15$	-0.760	0.284	0.007	$A153$	-0.852	0.104	0.000
$A21$	0.620	0.331	0.061	$A156$	-0.371	0.056	0.000
$A24$	-1.167	0.077	0.000	$A160$	-0.261	0.122	0.032
$A25$	-0.429	0.113	0.000	$A162$	1.590	0.369	0.000
$A26$	0.235	0.101	0.020	$A163$	0.744	0.158	0.000

$A100$	-0.521	0.239	0.029	$A164$	1.022	0.275	0.000
$A105$	-0.864	0.270	0.001	$A172$	-1.157	0.084	0.000
$A106$	-0.744	0.081	0.000	$A174$	1.086	0.384	0.005
$A108$	1.073	0.063	0.000	$A175$	0.615	0.086	0.000
$A112$	2.259	0.279	0.000	$A177$	1.706	0.216	0.000
$A113$	0.301	0.147	0.041	$A178$	0.572	0.121	0.000
$A114$	-0.560	0.241	0.020	$A183$	1.939	0.413	0.000
$A116$	0.814	0.252	0.001	$A189$	-0.794	0.169	0.000
$A117$	-1.049	0.136	0.000	$A193$	-0.762	0.162	0.000
$A122$	-0.878	0.072	0.000	$A194$	-0.660	0.248	0.008
$A128$	0.887	0.251	0.000	$A201$	-0.723	0.087	0.000
$A129$	-0.535	0.064	0.000	$A202$	1.932	0.083	0.000
$A130$	1.675	0.233	0.000	$A203$	-1.647	0.080	0.000
$A133$	1.178	0.309	0.000	$A204$	1.407	0.088	0.000
$A134$	0.718	0.185	0.000	$A206$	0.621	0.139	0.000
$A138$	0.433	0.157	0.006	$A207$	-0.574	0.157	0.000
$A139$	1.185	0.081	0.000	$A213$	0.768	0.102	0.000
$A140$	-0.490	0.132	0.000	$A218$	-0.950	0.055	0.000
$A143$	0.945	0.103	0.000	$A230$	2.035	0.167	0.000
$public$	-0.481	0.083	0.000	t_2	-0.134	0.060	0.026
$share_t$	-1.975	0.598	0.001	t_3	-0.241	0.080	0.003
k	9.886	0.056	0.000	t_6	-0.176	0.069	0.011
Obs.	1774						
R^2_{adj}	0.400						

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $public$, $share_t$, t_2, t_3, t_4, t_5, t_6. Only observations for which $sculpture = 1$ have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

Table B.2.4: Hedonic regression on graphics sub-sample

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A3$	-0.542	0.117	0.000	$A145$	0.452	0.132	0.001
$A19$	-0.582	0.103	0.000	$A149$	0.620	0.056	0.000
$A21$	0.488	0.090	0.000	$A153$	-0.533	0.055	0.000
$A26$	-0.641	0.104	0.000	$A156$	-0.674	0.055	0.000
$A100$	-0.470	0.090	0.000	$A163$	-0.495	0.101	0.000
$A105$	0.384	0.075	0.000	$A174$	0.540	0.230	0.020
$A108$	-0.585	0.055	0.000	$A175$	0.758	0.135	0.000
$A116$	-0.506	0.057	0.000	$A189$	-0.448	0.065	0.000
$A128$	-0.701	0.056	0.000	$A196$	0.623	0.059	0.000
$A133$	-0.502	0.124	0.000	$A199$	-0.445	0.141	0.002
$A142$	-0.327	0.096	0.001	t_3	0.272	0.076	0.000
$share_t$	-4.392	1.100	0.000	t_5	0.269	0.099	0.007

k	8.832	0.056	0.000		
Obs.	342				
R^2_{adj}	0.236				

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $public$, $share_t$, t_2, t_3, t_4, t_5, t_6. Only observations for which $graphics = 1$ have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

B.3 Results of the OLS estimation of the model in (4.6) in the sub-samples of each of the years

Table B.3.1: Hedonic regression for year 1

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A3$	0.877	0.189	0.000	$A150$	-0.557	0.127	0.000
$A4$	-0.961	0.040	0.000	$A151$	-0.806	0.070	0.000
$A5$	-0.546	0.127	0.000	$A152$	-0.810	0.088	0.000
$A6$	-0.802	0.136	0.000	$A153$	-0.863	0.057	0.000
$A7$	-0.879	0.070	0.000	$A154$	-0.284	0.045	0.000
$A8$	0.651	0.268	0.015	$A156$	-0.587	0.110	0.000
$A9$	-0.390	0.202	0.054	$A157$	-0.342	0.192	0.075
$A10$	-0.242	0.137	0.078	$A159$	-0.878	0.051	0.000
$A11$	-0.146	0.076	0.053	$A161$	-0.830	0.105	0.000
$A12$	-1.078	0.059	0.000	$A163$	0.453	0.124	0.000
$A13$	-0.711	0.177	0.000	$A164$	0.674	0.353	0.056
$A14$	-0.753	0.162	0.000	$A166$	-0.365	0.219	0.096
$A17$	0.796	0.287	0.006	$A167$	-0.724	0.070	0.000
$A20$	-0.912	0.067	0.000	$A168$	-0.281	0.084	0.001
$A22$	-0.455	0.086	0.000	$A172$	-0.551	0.113	0.000
$A23$	-0.915	0.117	0.000	$A175$	0.601	0.059	0.000
$A24$	-0.909	0.091	0.000	$A178$	0.667	0.279	0.017
$A25$	-0.911	0.055	0.000	$A179$	-0.986	0.124	0.000
$A27$	-0.889	0.156	0.000	$A180$	-1.004	0.086	0.000
$A28$	-0.877	0.084	0.000	$A181$	-0.758	0.222	0.001
$A100$	-0.715	0.062	0.000	$A183$	1.455	0.156	0.000
$A101$	-0.827	0.084	0.000	$A187$	-0.789	0.085	0.000
$A104$	-0.599	0.213	0.005	$A188$	0.378	0.088	0.000
$A105$	-0.550	0.096	0.000	$A189$	0.171	0.097	0.077
$A108$	0.739	0.162	0.000	$A190$	-0.829	0.080	0.000

$A110$	-0.540	0.202	0.008	$A191$	-0.437	0.132	0.001
$A112$	2.041	0.362	0.000	$A192$	0.360	0.197	0.068
$A113$	0.763	0.380	0.045	$A193$	-0.333	0.129	0.010
$A114$	-0.459	0.209	0.029	$A196$	-0.246	0.081	0.002
$A115$	-0.689	0.069	0.000	$A197$	-0.556	0.109	0.000
$A117$	0.638	0.362	0.078	$A199$	0.525	0.264	0.047
$A118$	-0.789	0.088	0.000	$A200$	-0.775	0.198	0.000
$A120$	-0.530	0.104	0.000	$A201$	-0.793	0.117	0.000
$A122$	-1.196	0.075	0.000	$A204$	0.815	0.201	0.000
$A123$	-0.442	0.190	0.020	$A206$	0.433	0.161	0.007
$A124$	-0.724	0.095	0.000	$A208$	-0.754	0.111	0.000
$A128$	-0.956	0.094	0.000	$A210$	-0.585	0.173	0.001
$A129$	-0.347	0.094	0.000	$A211$	-0.548	0.134	0.000
$A130$	2.629	0.438	0.000	$A212$	1.598	0.196	0.000
$A132$	-1.377	0.119	0.000	$A213$	1.575	0.298	0.000
$A135$	1.259	0.175	0.000	$A214$	-0.832	0.177	0.000
$A136$	0.854	0.215	0.000	$A215$	-0.722	0.292	0.013
$A141$	-0.446	0.121	0.000	$A218$	-0.234	0.060	0.000
$A143$	1.166	0.203	0.000	$A220$	-0.597	0.266	0.025
$A144$	-0.485	0.071	0.000	$A221$	0.950	0.171	0.000
$A145$	0.804	0.191	0.000	$A222$	-0.597	0.188	0.002
$A148$	-0.682	0.211	0.001	$A223$	0.520	0.133	0.000
$A149$	0.356	0.117	0.002	$A225$	-0.402	0.107	0.000
$art\ genre$	0.114	0.010	0.000	$share_t$	-1.665	0.154	0.000
k	8.978	0.046	0.000				
Obs.	4801						
R^2_{adj}	0.234						

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\ genre$, $public$, $share_t$. Only observations regarding artworks sold in year 1 have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

Table B.3.2: Hedonic regression for year 2

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.552	0.117	0.000	$A145$	1.484	0.346	0.000
$A2$	0.315	0.130	0.016	$A148$	-0.516	0.149	0.001
$A3$	1.302	0.261	0.000	$A149$	0.963	0.240	0.000
$A4$	-0.970	0.090	0.000	$A151$	-0.774	0.109	0.000
$A5$	-0.281	0.100	0.005	$A152$	-0.838	0.076	0.000
$A6$	-0.891	0.100	0.000	$A153$	-0.887	0.078	0.000
$A7$	-0.832	0.083	0.000	$A154$	-0.369	0.095	0.000
$A9$	-0.513	0.158	0.001	$A156$	-0.232	0.135	0.086
$A11$	-0.340	0.048	0.000	$A157$	1.203	0.373	0.001

$A12$	-0.969	0.078	0.000	$A159$	-0.944	0.081	0.000
$A13$	-0.696	0.114	0.000	$A161$	-0.969	0.067	0.000
$A14$	-1.152	0.105	0.000	$A163$	0.637	0.118	0.000
$A16$	0.961	0.494	0.052	$A164$	0.616	0.223	0.006
$A18$	-0.652	0.106	0.000	$A166$	-0.442	0.217	0.042
$A19$	-0.924	0.155	0.000	$A167$	-0.798	0.080	0.000
$A21$	-0.509	0.219	0.020	$A168$	-0.330	0.106	0.002
$A22$	-0.227	0.127	0.074	$A169$	-0.512	0.107	0.000
$A23$	-0.590	0.199	0.003	$A170$	1.168	0.674	0.083
$A24$	-0.453	0.168	0.007	$A172$	-0.922	0.111	0.000
$A25$	-0.541	0.110	0.000	$A175$	0.503	0.138	0.000
$A28$	-0.739	0.158	0.000	$A176$	-0.409	0.109	0.000
$A100$	-0.569	0.082	0.000	$A178$	0.594	0.199	0.003
$A101$	-0.718	0.080	0.000	$A179$	-0.687	0.158	0.000
$A103$	-0.622	0.186	0.001	$A180$	-0.542	0.072	0.000
$A104$	-0.554	0.071	0.000	$A183$	1.803	0.190	0.000
$A105$	-0.194	0.093	0.037	$A186$	-0.694	0.069	0.000
$A108$	1.085	0.205	0.000	$A187$	-1.010	0.068	0.000
$A110$	-0.552	0.108	0.000	$A190$	-0.740	0.109	0.000
$A112$	1.545	0.928	0.096	$A191$	-0.376	0.141	0.008
$A113$	1.310	0.170	0.000	$A192$	0.345	0.207	0.095
$A114$	-0.745	0.097	0.000	$A193$	-0.510	0.124	0.000
$A115$	-0.776	0.066	0.000	$A196$	0.280	0.066	0.000
$A116$	0.448	0.179	0.013	$A200$	-0.502	0.126	0.000
$A118$	-0.769	0.088	0.000	$A201$	-0.787	0.112	0.000
$A120$	-0.462	0.158	0.004	$A204$	0.998	0.172	0.000
$A122$	-1.050	0.039	0.000	$A205$	0.606	0.231	0.009
$A123$	-0.519	0.135	0.000	$A206$	1.429	0.217	0.000
$A124$	-0.797	0.079	0.000	$A208$	-0.789	0.131	0.000
$A125$	0.450	0.192	0.019	$A210$	-0.699	0.133	0.000
$A127$	-0.851	0.167	0.000	$A211$	-0.712	0.113	0.000
$A128$	0.397	0.071	0.000	$A212$	1.219	0.279	0.000
$A129$	-0.203	0.099	0.041	$A213$	1.377	0.139	0.000
$A130$	2.570	0.248	0.000	$A214$	-0.658	0.192	0.001
$A131$	-0.995	0.141	0.000	$A215$	-0.522	0.161	0.001
$A132$	-1.243	0.032	0.000	$A218$	-0.161	0.081	0.046
$A134$	1.116	0.471	0.018	$A220$	-1.117	0.064	0.000
$A135$	1.089	0.187	0.000	$A221$	1.151	0.116	0.000
$A136$	0.798	0.065	0.000	$A223$	0.665	0.137	0.000
$A139$	1.006	0.215	0.000	$A224$	0.490	0.088	0.000
$A140$	-0.467	0.163	0.004	$A225$	-0.504	0.115	0.000
$A141$	-0.507	0.148	0.001	$A226$	0.478	0.162	0.003
$A143$	1.134	0.222	0.000	$A228$	0.371	0.163	0.023
$A144$	-0.541	0.076	0.000	$A230$	0.660	0.161	0.000
$art\ genre$	0.038	0.010	0.000	$public$	-0.220	0.027	0.000
k	9.331	0.054	0.000				
Obs.	5866						

R^2_{adj}	0.216

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\ genre$, $public$, $share_t$. Only observations regarding artworks sold in year 2 have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

Table B.3.3: Hedonic regression for year 3

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A3$	0.666	0.311	0.032	$A144$	-0.842	0.099	0.000
$A4$	-1.008	0.181	0.000	$A148$	-0.631	0.185	0.001
$A6$	-0.700	0.240	0.004	$A150$	-0.524	0.180	0.004
$A7$	-0.732	0.371	0.049	$A151$	-0.775	0.118	0.000
$A8$	1.084	0.428	0.011	$A152$	-0.981	0.125	0.000
$A9$	-0.720	0.032	0.000	$A153$	-0.778	0.100	0.000
$A10$	0.528	0.189	0.005	$A154$	-0.604	0.150	0.000
$A11$	-0.381	0.088	0.000	$A157$	0.702	0.386	0.069
$A12$	-1.159	0.128	0.000	$A159$	-0.573	0.318	0.071
$A13$	-0.548	0.128	0.000	$A160$	-0.491	0.244	0.044
$A14$	-1.152	0.145	0.000	$A161$	-0.880	0.158	0.000
$A16$	0.894	0.150	0.000	$A165$	-0.492	0.027	0.000
$A18$	-1.162	0.105	0.000	$A167$	-0.603	0.196	0.002
$A19$	-0.781	0.039	0.000	$A168$	-0.507	0.154	0.001
$A20$	-0.626	0.163	0.000	$A169$	-0.661	0.380	0.082
$A22$	-0.612	0.220	0.005	$A170$	-0.652	0.205	0.001
$A23$	-0.992	0.266	0.000	$A172$	-1.003	0.141	0.000
$A24$	-1.024	0.130	0.000	$A173$	0.599	0.290	0.039
$A25$	-0.789	0.104	0.000	$A174$	0.617	0.350	0.078
$A27$	-0.500	0.212	0.018	$A176$	-0.709	0.138	0.000
$A28$	-0.677	0.139	0.000	$A179$	-1.006	0.153	0.000
$A100$	-0.544	0.116	0.000	$A180$	-0.781	0.162	0.000
$A101$	-0.776	0.085	0.000	$A181$	-0.820	0.324	0.012
$A104$	-0.979	0.181	0.000	$A183$	1.236	0.405	0.002
$A105$	-0.479	0.150	0.001	$A185$	-0.353	0.189	0.061
$A106$	-0.325	0.117	0.005	$A186$	-0.807	0.112	0.000
$A107$	-1.061	0.094	0.000	$A187$	-1.050	0.053	0.000
$A108$	1.260	0.288	0.000	$A189$	-0.280	0.143	0.050
$A109$	-0.389	0.161	0.016	$A190$	-0.813	0.104	0.000
$A110$	-0.333	0.121	0.006	$A191$	-0.446	0.174	0.011
$A111$	-0.676	0.076	0.000	$A193$	-0.315	0.167	0.060
$A112$	1.134	0.388	0.004	$A197$	-0.488	0.189	0.010
$A114$	-1.014	0.109	0.000	$A200$	-0.676	0.186	0.000
$A115$	-1.072	0.073	0.000	$A201$	-0.953	0.121	0.000
$A117$	0.780	0.340	0.022	$A204$	0.668	0.241	0.006

$A118$	-0.973	0.103	0.000	$A206$	0.803	0.075	0.000
$A120$	-0.724	0.128	0.000	$A207$	-0.581	0.239	0.015
$A121$	-0.300	0.143	0.036	$A208$	-1.013	0.169	0.000
$A122$	-1.121	0.178	0.000	$A209$	-0.489	0.187	0.009
$A123$	-0.819	0.186	0.000	$A210$	-0.666	0.167	0.000
$A124$	-1.393	0.126	0.000	$A211$	-0.961	0.093	0.000
$A126$	-0.763	0.047	0.000	$A212$	1.181	0.372	0.002
$A128$	-1.020	0.191	0.000	$A213$	0.858	0.259	0.001
$A129$	-0.213	0.116	0.067	$A214$	-0.479	0.242	0.048
$A130$	2.271	0.585	0.000	$A217$	0.824	0.251	0.001
$A131$	-0.793	0.193	0.000	$A218$	-0.334	0.100	0.001
$A132$	-1.293	0.047	0.000	$A220$	-0.846	0.135	0.000
$A134$	-0.836	0.365	0.022	$A221$	1.026	0.198	0.000
$A135$	1.665	0.222	0.000	$A222$	-0.599	0.191	0.002
$A136$	0.465	0.231	0.044	$A223$	0.578	0.173	0.001
$A137$	-0.367	0.215	0.087	$A225$	-0.590	0.118	0.000
$A139$	0.943	0.299	0.002	$A226$	0.673	0.273	0.014
$A142$	-0.744	0.170	0.000	$A228$	-0.380	0.208	0.068
$A143$	0.650	0.277	0.019	$A229$	-0.449	0.242	0.064
$art\,gen$	0.077	0.014	0.000	$public$	-0.345	0.037	0.000
k	9.309	0.069	0.000				
Obs.	2754						
R^2_{adj}	0.234						

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_t$. Only observations regarding artworks sold in year 3 have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

Table B.3.4: Hedonic regression for year 4

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.290	0.115	0.012	$A149$	0.815	0.189	0.000
$A2$	0.323	0.131	0.014	$A151$	-0.738	0.129	0.000
$A3$	0.922	0.237	0.000	$A152$	-0.768	0.104	0.000
$A4$	-1.056	0.109	0.000	$A153$	-0.931	0.140	0.000
$A7$	-0.799	0.115	0.000	$A154$	-0.984	0.099	0.000
$A8$	0.999	0.380	0.009	$A156$	-0.339	0.129	0.009
$A9$	-0.808	0.383	0.035	$A157$	0.897	0.311	0.004
$A12$	-0.875	0.095	0.000	$A158$	0.926	0.134	0.000
$A13$	-0.930	0.093	0.000	$A159$	-0.607	0.121	0.000
$A14$	-0.846	0.176	0.000	$A161$	-0.534	0.189	0.005
$A15$	0.446	0.152	0.003	$A163$	0.544	0.191	0.004
$A17$	1.058	0.355	0.003	$A164$	0.510	0.267	0.056
$A18$	-0.540	0.104	0.000	$A165$	-0.497	0.208	0.017

$A20$	-0.735	0.173	0.000	$A166$	-0.749	0.126	0.000
$A21$	0.336	0.145	0.020	$A167$	-0.800	0.098	0.000
$A22$	-0.456	0.198	0.021	$A168$	-0.365	0.095	0.000
$A24$	-0.963	0.102	0.000	$A169$	-0.329	0.125	0.009
$A25$	-0.317	0.087	0.000	$A170$	-0.297	0.152	0.051
$A27$	-0.669	0.054	0.000	$A171$	0.187	0.103	0.070
$A28$	-0.563	0.150	0.000	$A172$	-0.790	0.112	0.000
$A29$	1.489	0.351	0.000	$A174$	0.638	0.251	0.011
$A100$	-0.943	0.092	0.000	$A176$	-0.553	0.192	0.004
$A101$	-0.919	0.053	0.000	$A178$	0.746	0.234	0.001
$A102$	-0.310	0.162	0.056	$A179$	-1.038	0.173	0.000
$A103$	-0.696	0.132	0.000	$A180$	-0.823	0.076	0.000
$A104$	-1.270	0.028	0.000	$A183$	1.221	0.243	0.000
$A105$	-0.439	0.130	0.001	$A184$	0.335	0.202	0.098
$A108$	0.985	0.241	0.000	$A185$	-0.991	0.127	0.000
$A110$	-0.586	0.204	0.004	$A186$	-0.772	0.115	0.000
$A112$	3.354	0.068	0.000	$A187$	-0.881	0.098	0.000
$A114$	-0.450	0.135	0.001	$A188$	0.299	0.117	0.010
$A115$	-1.038	0.054	0.000	$A190$	-0.841	0.113	0.000
$A118$	-0.749	0.079	0.000	$A191$	-0.740	0.167	0.000
$A120$	-0.636	0.137	0.000	$A193$	-0.431	0.157	0.006
$A121$	-0.184	0.103	0.073	$A195$	0.560	0.172	0.001
$A122$	-1.133	0.060	0.000	$A198$	-0.702	0.190	0.000
$A123$	-0.524	0.260	0.044	$A201$	-0.501	0.105	0.000
$A124$	-0.884	0.090	0.000	$A204$	0.592	0.274	0.031
$A127$	-0.651	0.373	0.081	$A206$	0.400	0.107	0.000
$A128$	-0.526	0.098	0.000	$A207$	-0.738	0.086	0.000
$A129$	-0.368	0.094	0.000	$A208$	-1.027	0.137	0.000
$A130$	2.127	0.643	0.001	$A209$	-0.311	0.177	0.080
$A132$	-1.268	0.037	0.000	$A210$	-1.056	0.115	0.000
$A134$	0.507	0.295	0.085	$A211$	-0.691	0.099	0.000
$A135$	1.003	0.195	0.000	$A212$	0.824	0.401	0.040
$A136$	1.030	0.268	0.000	$A213$	0.597	0.105	0.000
$A137$	-0.428	0.162	0.009	$A215$	-0.666	0.156	0.000
$A138$	0.951	0.275	0.001	$A216$	-0.767	0.083	0.000
$A139$	1.188	0.185	0.000	$A218$	-0.243	0.136	0.074
$A140$	-0.379	0.183	0.038	$A220$	-0.750	0.246	0.002
$A141$	-0.879	0.260	0.001	$A221$	0.693	0.142	0.000
$A143$	0.954	0.171	0.000	$A222$	-0.906	0.067	0.000
$A144$	-0.740	0.088	0.000	$A223$	0.712	0.204	0.000
$A145$	0.726	0.343	0.034	$A225$	-0.538	0.118	0.000
$A146$	-0.618	0.318	0.052	$A229$	-0.845	0.168	0.000
$A148$	-0.475	0.206	0.021	$public$	-0.210	0.040	0.000
$art\,gen$	0.095	0.014	0.000	$share_t$	-1.001	0.321	0.002
k	9.164	0.066	0.000				
Obs.	3795						

R^2_{adj}	0.223

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\ genre$, $public$, $share_t$. Only observations regarding artworks sold in year 4 have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

Table B.3.5: Hedonic regression for year 5

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A3$	0.830	0.234	0.000	$A147$	-0.464	0.161	0.004
$A4$	-0.889	0.084	0.000	$A148$	-0.984	0.181	0.000
$A5$	-0.296	0.152	0.051	$A149$	0.663	0.202	0.001
$A6$	-1.103	0.064	0.000	$A151$	-1.265	0.078	0.000
$A7$	-1.387	0.108	0.000	$A152$	-1.039	0.165	0.000
$A8$	0.928	0.397	0.019	$A153$	-1.046	0.140	0.000
$A9$	-1.332	0.106	0.000	$A154$	-0.893	0.124	0.000
$A10$	-0.496	0.085	0.000	$A156$	-0.304	0.145	0.036
$A11$	-0.380	0.105	0.000	$A159$	-0.575	0.112	0.000
$A12$	-1.311	0.034	0.000	$A160$	-0.330	0.140	0.018
$A13$	-0.923	0.113	0.000	$A161$	-1.415	0.132	0.000
$A14$	-1.139	0.087	0.000	$A165$	-0.613	0.272	0.024
$A16$	1.300	0.164	0.000	$A166$	-0.807	0.413	0.051
$A18$	-1.216	0.069	0.000	$A167$	-0.803	0.173	0.000
$A20$	-0.668	0.286	0.020	$A168$	-0.469	0.126	0.000
$A21$	-0.424	0.124	0.001	$A169$	-0.592	0.277	0.033
$A22$	-0.758	0.138	0.000	$A170$	-0.360	0.190	0.058
$A23$	-1.037	0.219	0.000	$A172$	-1.231	0.058	0.000
$A24$	-1.383	0.071	0.000	$A178$	0.680	0.261	0.009
$A25$	-0.198	0.110	0.072	$A179$	-1.271	0.141	0.000
$A27$	-0.824	0.208	0.000	$A180$	-1.113	0.149	0.000
$A28$	-0.602	0.112	0.000	$A181$	-0.210	0.109	0.055
$A100$	-0.921	0.091	0.000	$A182$	-0.724	0.106	0.000
$A101$	-1.068	0.083	0.000	$A183$	1.873	0.180	0.000
$A103$	-0.388	0.079	0.000	$A184$	-0.646	0.227	0.004
$A104$	-0.777	0.165	0.000	$A185$	-0.320	0.174	0.067
$A105$	-0.910	0.126	0.000	$A186$	-0.379	0.032	0.000
$A108$	0.414	0.125	0.001	$A187$	-0.957	0.109	0.000
$A109$	-0.355	0.189	0.061	$A188$	0.258	0.142	0.070
$A110$	-0.709	0.188	0.000	$A189$	-0.690	0.070	0.000
$A111$	-0.558	0.231	0.015	$A190$	-0.805	0.186	0.000
$A112$	1.735	0.787	0.028	$A193$	-0.700	0.163	0.000
$A114$	-0.952	0.141	0.000	$A194$	-0.408	0.102	0.000
$A115$	-1.208	0.053	0.000	$A196$	-0.414	0.081	0.000
$A116$	0.420	0.211	0.047	$A200$	-0.652	0.225	0.004

$A118$	-1.119	0.092	0.000	$A201$	-0.823	0.106	0.000
$A120$	-0.602	0.151	0.000	$A202$	-0.617	0.077	0.000
$A121$	-0.502	0.132	0.000	$A203$	-1.104	0.032	0.000
$A122$	-1.300	0.144	0.000	$A206$	0.386	0.154	0.012
$A123$	-1.147	0.130	0.000	$A208$	-0.998	0.144	0.000
$A124$	-1.021	0.109	0.000	$A209$	-0.746	0.124	0.000
$A128$	-0.599	0.090	0.000	$A210$	-0.952	0.143	0.000
$A129$	-0.667	0.109	0.000	$A211$	-0.991	0.163	0.000
$A130$	2.330	0.378	0.000	$A213$	0.714	0.082	0.000
$A131$	-0.689	0.326	0.034	$A215$	-0.469	0.200	0.019
$A133$	-0.625	0.239	0.009	$A216$	-0.710	0.168	0.000
$A135$	0.433	0.238	0.069	$A217$	0.703	0.174	0.000
$A137$	-0.491	0.181	0.007	$A218$	-0.505	0.135	0.000
$A140$	-0.918	0.235	0.000	$A220$	-1.122	0.146	0.000
$A141$	-0.687	0.159	0.000	$A222$	-0.985	0.098	0.000
$A143$	0.726	0.221	0.001	$A223$	0.719	0.188	0.000
$A144$	-0.767	0.119	0.000	$A225$	-0.879	0.110	0.000
$A145$	1.549	0.358	0.000	$A226$	-0.451	0.262	0.085
$A146$	-0.790	0.307	0.010	$A229$	-1.433	0.132	0.000
$art\,gen$	0.034	0.013	0.010	$share_t$	-1.701	0.355	0.000
k	9.604	0.062	0.000	$public$	-0.226	0.044	0.000
Obs.	3578						
R^2_{adj}	0.238						

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_t$. Only observations regarding artworks sold in year 5 have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

Table B.3.6: Hedonic regression for year 6

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A3$	0.680	0.200	0.001	$A153$	-1.132	0.099	0.000
$A4$	-0.867	0.091	0.000	$A154$	-0.776	0.356	0.029
$A6$	-0.682	0.189	0.000	$A155$	-0.796	0.180	0.000
$A9$	-0.734	0.418	0.079	$A156$	-0.634	0.238	0.008
$A11$	-0.646	0.131	0.000	$A159$	-0.598	0.091	0.000
$A12$	-1.103	0.068	0.000	$A160$	-0.450	0.240	0.061
$A13$	-1.156	0.160	0.000	$A161$	-0.867	0.091	0.000
$A14$	-1.275	0.130	0.000	$A163$	0.386	0.216	0.075
$A16$	1.563	0.138	0.000	$A165$	-1.336	0.091	0.000
$A17$	0.518	0.295	0.079	$A166$	-0.775	0.227	0.001
$A18$	-0.861	0.190	0.000	$A167$	-0.888	0.174	0.000
$A19$	-0.702	0.234	0.003	$A168$	-0.548	0.113	0.000
$A21$	-0.539	0.110	0.000	$A169$	-0.609	0.287	0.034

$A22$	0.225	0.126	0.073	$A172$	-1.152	0.071	0.000
$A23$	-1.296	0.168	0.000	$A174$	-0.430	0.240	0.073
$A24$	-1.450	0.105	0.000	$A175$	0.491	0.069	0.000
$A25$	-0.691	0.133	0.000	$A176$	-0.755	0.119	0.000
$A27$	-0.800	0.230	0.001	$A179$	-1.266	0.186	0.000
$A28$	-0.441	0.122	0.000	$A180$	-1.191	0.104	0.000
$A100$	-1.230	0.046	0.000	$A181$	-0.552	0.104	0.000
$A101$	-1.103	0.065	0.000	$A182$	-0.592	0.220	0.007
$A103$	-0.735	0.139	0.000	$A184$	-1.011	0.161	0.000
$A104$	-0.776	0.152	0.000	$A185$	-0.533	0.307	0.083
$A105$	-0.612	0.117	0.000	$A186$	-0.991	0.078	0.000
$A108$	0.853	0.148	0.000	$A187$	-0.817	0.275	0.003
$A109$	-0.429	0.237	0.070	$A188$	-0.266	0.129	0.039
$A110$	-0.880	0.304	0.004	$A189$	-0.883	0.118	0.000
$A111$	-1.287	0.186	0.000	$A190$	-0.694	0.130	0.000
$A112$	2.988	0.042	0.000	$A191$	-0.885	0.196	0.000
$A113$	2.268	1.142	0.047	$A194$	-0.339	0.110	0.002
$A114$	-0.747	0.191	0.000	$A196$	-0.306	0.115	0.008
$A115$	-1.113	0.112	0.000	$A198$	-1.096	0.110	0.000
$A118$	-1.146	0.117	0.000	$A199$	-0.514	0.255	0.044
$A119$	0.925	0.547	0.091	$A200$	-0.605	0.182	0.001
$A120$	-0.675	0.122	0.000	$A201$	-0.953	0.092	0.000
$A121$	-0.526	0.159	0.001	$A202$	-0.354	0.155	0.023
$A122$	-1.381	0.095	0.000	$A203$	-0.438	0.252	0.083
$A123$	-0.919	0.276	0.001	$A204$	0.598	0.136	0.000
$A124$	-0.931	0.103	0.000	$A206$	0.913	0.331	0.006
$A125$	-0.517	0.243	0.034	$A207$	0.471	0.176	0.007
$A128$	-0.295	0.102	0.004	$A208$	-1.125	0.110	0.000
$A129$	-0.509	0.191	0.008	$A209$	-0.724	0.154	0.000
$A130$	1.059	0.463	0.022	$A210$	-0.719	0.093	0.000
$A132$	-0.939	0.115	0.000	$A211$	-0.893	0.171	0.000
$A135$	0.618	0.280	0.028	$A212$	1.089	0.226	0.000
$A140$	-0.803	0.174	0.000	$A213$	0.538	0.130	0.000
$A141$	-0.660	0.202	0.001	$A215$	-1.017	0.132	0.000
$A142$	-0.903	0.176	0.000	$A216$	-0.510	0.140	0.000
$A143$	0.779	0.250	0.002	$A217$	0.346	0.156	0.027
$A144$	-0.906	0.140	0.000	$A218$	-0.547	0.114	0.000
$A145$	0.853	0.382	0.026	$A220$	-1.011	0.189	0.000
$A146$	0.771	0.251	0.002	$A222$	-1.116	0.062	0.000
$A148$	-0.701	0.173	0.000	$A223$	0.653	0.185	0.000
$A149$	0.849	0.334	0.011	$A225$	-1.010	0.140	0.000
$A150$	-1.139	0.044	0.000	$A228$	-0.425	0.125	0.001
$A151$	-1.178	0.071	0.000	$A229$	-0.585	0.243	0.016
$A152$	-1.254	0.087	0.000	$public$	-0.244	0.053	0.000
$art\,gen$	0.072	0.017	0.000	$share_t$	-2.380	0.380	0.000
k	9.529	0.085	0.000				
Obs.	3068						

R^2_{adj}	0.225

Notes: Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\ genre$, $public$, $share_t$. Only observations regarding artworks sold in year 6 have been used in the computation. Robust standard error are reported. All results are rounded at the third digit.

B.4 Results of the quantile regression estimation of the model in (4.7) with $q = 0.33$ and $q = 0.67$

Table B.4.1: Hedonic quantile model for $q = 0.33$ on overall data

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.533	0.062	0.000	$A152$	-0.502	0.087	0.000
$A2$	0.570	0.121	0.000	$A153$	-0.476	0.023	0.000
$A3$	0.810	0.179	0.000	$A155$	0.118	0.070	0.093
$A4$	-0.514	0.015	0.000	$A157$	0.130	0.041	0.002
$A6$	-0.566	0.028	0.000	$A159$	-0.388	0.041	0.000
$A7$	-0.471	0.094	0.000	$A161$	-0.553	0.026	0.000
$A8$	0.683	0.224	0.002	$A162$	0.253	0.031	0.000
$A10$	0.279	0.072	0.000	$A163$	0.629	0.029	0.000
$A12$	-0.553	0.016	0.000	$A164$	0.452	0.064	0.000
$A13$	-0.229	0.045	0.000	$A166$	-0.426	0.095	0.000
$A14$	-0.624	0.016	0.000	$A167$	-0.423	0.013	0.000
$A15$	0.326	0.055	0.000	$A168$	-0.142	0.060	0.019
$A16$	1.513	0.156	0.000	$A170$	-0.152	0.018	0.000
$A17$	0.613	0.097	0.000	$A171$	0.458	0.030	0.000
$A18$	-0.287	0.024	0.000	$A172$	-0.499	0.025	0.000
$A19$	-0.342	0.041	0.000	$A174$	-0.278	0.049	0.000
$A20$	-0.236	0.052	0.000	$A175$	1.012	0.036	0.000
$A21$	0.364	0.139	0.009	$A176$	-0.160	0.045	0.000
$A23$	-0.419	0.114	0.000	$A178$	0.456	0.125	0.000
$A24$	-0.581	0.058	0.000	$A179$	-0.693	0.033	0.000
$A28$	-0.207	0.086	0.017	$A180$	-0.423	0.026	0.000
$A29$	0.304	0.049	0.000	$A181$	0.199	0.023	0.000
$A100$	-0.423	0.026	0.000	$A182$	0.205	0.023	0.000
$A101$	-0.389	0.012	0.000	$A183$	1.555	0.296	0.000
$A103$	-0.211	0.091	0.021	$A184$	0.232	0.027	0.000
$A104$	-0.272	0.083	0.001	$A186$	-0.261	0.030	0.000

$A105$	-0.241	0.071	0.001	$A187$	-0.451	0.045	0.000
$A106$	-0.146	0.078	0.061	$A188$	0.604	0.086	0.000
$A107$	0.114	0.019	0.000	$A189$	-0.192	0.012	0.000
$A108$	1.146	0.025	0.000	$A190$	-0.484	0.022	0.000
$A110$	-0.199	0.022	0.000	$A191$	-0.235	0.028	0.000
$A112$	1.612	0.055	0.000	$A192$	0.171	0.082	0.036
$A113$	0.905	0.121	0.000	$A195$	0.405	0.106	0.000
$A114$	-0.383	0.019	0.000	$A196$	0.069	0.039	0.077
$A115$	-0.598	0.025	0.000	$A200$	-0.287	0.045	0.000
$A116$	0.271	0.022	0.000	$A201$	-0.360	0.066	0.000
$A117$	0.681	0.146	0.000	$A202$	-0.115	0.036	0.002
$A118$	-0.461	0.021	0.000	$A204$	1.033	0.054	0.000
$A122$	-0.638	0.017	0.000	$A205$	0.529	0.047	0.000
$A123$	-0.420	0.035	0.000	$A206$	1.106	0.092	0.000
$A124$	-0.451	0.033	0.000	$A207$	-0.152	0.028	0.000
$A125$	0.345	0.108	0.001	$A208$	-0.539	0.018	0.000
$A127$	-0.435	0.073	0.000	$A210$	-0.467	0.066	0.000
$A130$	2.432	0.184	0.000	$A211$	-0.248	0.028	0.000
$A131$	-0.402	0.096	0.000	$A212$	1.231	0.073	0.000
$A132$	-0.676	0.036	0.000	$A213$	1.306	0.115	0.000
$A133$	-0.189	0.113	0.095	$A214$	-0.237	0.015	0.000
$A134$	0.385	0.131	0.003	$A215$	-0.316	0.032	0.000
$A135$	1.098	0.132	0.000	$A217$	0.881	0.113	0.000
$A136$	1.219	0.151	0.000	$A220$	-0.549	0.062	0.000
$A140$	-0.230	0.129	0.075	$A221$	1.243	0.154	0.000
$A141$	-0.172	0.076	0.024	$A222$	-0.336	0.138	0.015
$A142$	-0.294	0.039	0.000	$A223$	0.709	0.089	0.000
$A143$	1.247	0.168	0.000	$A224$	0.639	0.131	0.000
$A144$	-0.351	0.045	0.000	$A225$	-0.182	0.077	0.018
$A145$	0.603	0.126	0.000	$A226$	0.536	0.187	0.004
$A149$	0.615	0.181	0.001	$A228$	0.405	0.086	0.000
$A151$	-0.471	0.065	0.000	$A230$	0.628	0.217	0.004
$share_t$	-0.170	0.082	0.039	t_2	0.051	0.010	0.000
$art\,gen$	0.048	0.003	0.000	t_4	0.024	0.010	0.015
$public$	-0.252	0.010	0.000	t_5	-0.029	0.012	0.018
k	8.697	0.017	0.000	t_6	0.042	0.017	0.012
Obs.	23862						

Notes: Quantile regression for $q = 0.33$. Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_t$, t_2, t_3, t_4, t_5, t_6. Robust standard error are reported. All results are rounded at the third digit.

Table B.4.2: Hedonic quantile model for $q = 0.67$ on overall data

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.288	0.057	0.000	$A150$	-0.302	0.145	0.038
$A2$	0.301	0.070	0.000	$A151$	-1.018	0.038	0.000
$A3$	1.222	0.099	0.000	$A152$	-1.056	0.020	0.000
$A4$	-1.102	0.244	0.000	$A153$	-1.148	0.057	0.000
$A6$	-1.233	0.056	0.000	$A154$	-0.824	0.075	0.000
$A7$	-1.115	0.051	0.000	$A155$	-0.324	0.165	0.050
$A8$	0.916	0.260	0.000	$A156$	-0.387	0.036	0.000
$A9$	-0.666	0.206	0.001	$A159$	-0.693	0.035	0.000
$A10$	-0.097	0.030	0.001	$A160$	-0.205	0.112	0.067
$A11$	-0.408	0.050	0.000	$A161$	-1.242	0.075	0.000
$A12$	-1.293	0.024	0.000	$A163$	0.503	0.054	0.000
$A13$	-0.869	0.139	0.000	$A165$	-0.451	0.111	0.000
$A14$	-1.196	0.059	0.000	$A166$	-0.642	0.225	0.004
$A15$	0.375	0.096	0.000	$A167$	-0.980	0.091	0.000
$A16$	1.174	0.095	0.000	$A168$	-0.422	0.075	0.000
$A17$	0.671	0.114	0.000	$A169$	-0.717	0.174	0.000
$A18$	-0.891	0.113	0.000	$A170$	-0.498	0.114	0.000
$A19$	-0.604	0.145	0.000	$A172$	-1.216	0.021	0.000
$A20$	-0.870	0.078	0.000	$A175$	0.244	0.054	0.000
$A22$	-0.549	0.123	0.000	$A176$	-0.527	0.099	0.000
$A23$	-1.019	0.135	0.000	$A178$	0.593	0.125	0.000
$A24$	-1.080	0.092	0.000	$A179$	-1.184	0.088	0.000
$A25$	-0.498	0.071	0.000	$A180$	-0.946	0.122	0.000
$A27$	-0.542	0.076	0.000	$A182$	-0.201	0.092	0.029
$A28$	-0.616	0.059	0.000	$A183$	1.532	0.090	0.000
$A29$	0.377	0.127	0.003	$A184$	-0.138	0.039	0.000
$A100$	-0.980	0.035	0.000	$A185$	-0.175	0.088	0.047
$A101$	-1.077	0.026	0.000	$A186$	-1.012	0.383	0.008
$A103$	-0.595	0.069	0.000	$A187$	-1.087	0.058	0.000
$A104$	-0.869	0.126	0.000	$A188$	0.204	0.060	0.001
$A105$	-0.546	0.107	0.000	$A189$	-0.303	0.083	0.000
$A108$	0.929	0.144	0.000	$A190$	-0.991	0.101	0.000
$A110$	-0.703	0.034	0.000	$A191$	-0.639	0.185	0.001
$A112$	2.707	0.206	0.000	$A193$	-0.527	0.099	0.000
$A113$	0.676	0.017	0.000	$A194$	-0.180	0.074	0.014
$A114$	-0.954	0.086	0.000	$A195$	0.366	0.214	0.088
$A115$	-1.136	0.053	0.000	$A197$	-0.393	0.081	0.000
$A116$	0.448	0.129	0.001	$A199$	0.666	0.266	0.012
$A117$	0.751	0.362	0.038	$A200$	-0.687	0.188	0.000
$A118$	-1.056	0.097	0.000	$A201$	-0.919	0.026	0.000
$A119$	0.524	0.284	0.065	$A202$	-0.363	0.077	0.000
$A120$	-0.696	0.086	0.000	$A204$	0.669	0.092	0.000

$A121$	-0.226	0.037	0.000	$A206$	0.588	0.019	0.000
$A122$	-1.393	0.042	0.000	$A207$	-0.348	0.059	0.000
$A123$	-0.728	0.093	0.000	$A208$	-1.102	0.111	0.000
$A124$	-1.051	0.047	0.000	$A209$	-0.379	0.066	0.000
$A126$	0.322	0.044	0.000	$A210$	-0.869	0.122	0.000
$A129$	-0.411	0.045	0.000	$A211$	-0.816	0.052	0.000
$A130$	2.756	0.170	0.000	$A212$	1.360	0.231	0.000
$A131$	-0.402	0.048	0.000	$A213$	0.815	0.077	0.000
$A132$	-1.379	0.205	0.000	$A214$	-0.362	0.142	0.011
$A135$	1.361	0.109	0.000	$A215$	-0.728	0.177	0.000
$A136$	0.607	0.130	0.000	$A216$	-0.526	0.119	0.000
$A139$	0.744	0.217	0.001	$A217$	0.600	0.128	0.000
$A140$	-0.514	0.082	0.000	$A218$	-0.319	0.042	0.000
$A141$	-0.547	0.034	0.000	$A220$	-1.058	0.082	0.000
$A142$	-0.589	0.110	0.000	$A221$	0.940	0.091	0.000
$A143$	1.101	0.089	0.000	$A222$	-0.991	0.177	0.000
$A144$	-0.784	0.055	0.000	$A223$	0.645	0.066	0.000
$A145$	0.808	0.155	0.000	$A225$	-0.730	0.035	0.000
$A148$	-0.725	0.097	0.000	$A227$	-0.101	0.019	0.000
$A149$	0.740	0.119	0.000	$A230$	0.485	0.106	0.000
$art\,gen$	0.072	0.004	0.000	t_2	0.059	0.015	0.000
$public$	-0.256	0.018	0.000	t_4	0.041	0.017	0.013
$share_t$	-0.804	0.131	0.000	t_6	0.059	0.018	0.001
k	9.582	0.025	0.000				
Obs.	23862						

Notes: Quantile regression for $q = 0.67$. Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_t$, t_2, t_3, t_4, t_5, t_6. Robust standard error are reported. All results are rounded at the third digit.

B.5 Results of the quantile regression estimation of the model in (4.8) with $q = 0.50$ for each of the six years

Table B.5.1: Hedonic quantile model for $q = 0.5$ for year 1

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.326	0.140	0.020	$A157$	-0.254	0.054	0.000
$A2$	0.594	0.297	0.046	$A158$	1.809	0.021	0.000
$A3$	0.749	0.226	0.001	$A159$	-0.644	0.076	0.000
$A5$	-0.304	0.095	0.001	$A161$	-0.700	0.135	0.000
$A6$	-0.856	0.134	0.000	$A163$	0.798	0.117	0.000
$A7$	-0.582	0.195	0.003	$A167$	-0.527	0.092	0.000
$A12$	-0.920	0.081	0.000	$A172$	-0.375	0.134	0.005
$A13$	-0.529	0.134	0.000	$A175$	0.812	0.077	0.000
$A14$	-0.626	0.220	0.004	$A177$	-0.619	0.207	0.003
$A15$	0.515	0.123	0.000	$A178$	0.644	0.123	0.000
$A17$	0.777	0.162	0.000	$A179$	-1.014	0.281	0.000
$A20$	-0.610	0.044	0.000	$A180$	-0.788	0.185	0.000
$A23$	-0.644	0.135	0.000	$A183$	1.635	0.037	0.000
$A24$	-0.718	0.184	0.000	$A187$	-0.470	0.214	0.028
$A27$	-1.003	0.201	0.000	$A188$	0.652	0.177	0.000
$A28$	-0.695	0.178	0.000	$A189$	0.429	0.115	0.000
$A101$	-0.598	0.190	0.002	$A190$	-0.694	0.102	0.000
$A105$	-0.470	0.189	0.013	$A191$	-0.144	0.028	0.000
$A108$	1.003	0.334	0.003	$A193$	-0.302	0.154	0.049
$A111$	0.164	0.022	0.000	$A196$	-0.181	0.080	0.023
$A113$	0.794	0.038	0.000	$A197$	-0.299	0.026	0.000
$A115$	-0.470	0.038	0.000	$A200$	-0.656	0.102	0.000
$A118$	-0.598	0.121	0.000	$A201$	-0.599	0.019	0.000
$A119$	-0.323	0.079	0.000	$A203$	0.717	0.048	0.000
$A120$	-0.288	0.069	0.000	$A204$	0.802	0.036	0.000
$A124$	-0.610	0.067	0.000	$A207$	0.269	0.038	0.000
$A128$	-0.718	0.214	0.001	$A208$	-0.598	0.216	0.006
$A130$	2.609	0.410	0.000	$A210$	-0.456	0.036	0.000
$A135$	1.711	0.107	0.000	$A211$	-0.319	0.074	0.000
$A136$	0.900	0.034	0.000	$A212$	1.872	0.207	0.000
$A138$	0.739	0.114	0.000	$A213$	1.680	0.342	0.000
$A139$	-0.237	0.040	0.000	$A214$	-0.609	0.265	0.022
$A143$	1.449	0.102	0.000	$A215$	-0.681	0.019	0.000
$A144$	-0.310	0.147	0.035	$A216$	0.188	0.048	0.000
$A145$	0.717	0.219	0.001	$A220$	-0.426	0.045	0.000
$A146$	0.410	0.019	0.000	$A221$	1.166	0.220	0.000

$A147$	0.612	0.238	0.010	$A223$	0.649	0.129	0.000
$A149$	0.638	0.190	0.001	$A224$	0.386	0.019	0.000
$A151$	-0.609	0.103	0.000	$A227$	0.318	0.058	0.000
$A152$	-0.644	0.169	0.000	$A230$	0.401	0.142	0.005
$A153$	-0.657	0.034	0.000	$art\,gen$	0.096	0.008	0.000
k	8.833	0.039	0.000	$share_t$	-1.646	0.132	0.000
Obs.	4801						

Notes: Quantile regression for $q = 0.50$, using data from year 1 only. Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_1$. Robust standard error are reported. All results are rounded at the third digit.

Table B.5.2: Hedonic quantile model for $q = 0.5$ for year 2

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.811	0.173	0.000	$A149$	1.034	0.321	0.001
$A2$	0.648	0.169	0.000	$A151$	-0.575	0.157	0.000
$A3$	2.015	0.091	0.000	$A152$	-0.498	0.020	0.000
$A4$	-0.766	0.091	0.000	$A153$	-0.693	0.113	0.000
$A6$	-0.855	0.095	0.000	$A159$	-0.598	0.212	0.005
$A7$	-0.575	0.022	0.000	$A160$	0.560	0.113	0.000
$A8$	0.629	0.276	0.023	$A161$	-0.744	0.100	0.000
$A11$	-0.146	0.020	0.000	$A162$	0.223	0.075	0.003
$A12$	-0.692	0.115	0.000	$A163$	0.965	0.143	0.000
$A13$	-0.326	0.144	0.024	$A164$	0.486	0.098	0.000
$A15$	0.577	0.327	0.078	$A167$	-0.575	0.047	0.000
$A16$	1.253	0.478	0.009	$A168$	-0.208	0.121	0.086
$A18$	-0.418	0.080	0.000	$A171$	0.405	0.153	0.008
$A19$	-0.718	0.214	0.001	$A172$	-0.693	0.098	0.000
$A21$	-0.421	0.166	0.011	$A175$	0.770	0.065	0.000
$A24$	-0.355	0.105	0.001	$A176$	-0.208	0.107	0.052
$A25$	-0.192	0.107	0.073	$A178$	0.636	0.242	0.009
$A27$	0.363	0.162	0.025	$A179$	-0.644	0.072	0.000
$A100$	-0.375	0.087	0.000	$A181$	0.405	0.226	0.073
$A104$	-0.288	0.128	0.025	$A183$	2.076	0.053	0.000
$A108$	1.504	0.431	0.000	$A187$	-0.693	0.053	0.000
$A110$	-0.134	0.042	0.001	$A188$	0.588	0.052	0.000
$A113$	1.386	0.081	0.000	$A190$	-0.644	0.031	0.000
$A114$	-0.662	0.026	0.000	$A192$	0.318	0.132	0.016
$A115$	-0.470	0.037	0.000	$A193$	-0.288	0.121	0.017
$A116$	0.646	0.377	0.086	$A194$	0.272	0.078	0.000
$A118$	-0.575	0.115	0.000	$A196$	0.560	0.083	0.000
$A120$	-0.208	0.086	0.015	$A198$	0.754	0.118	0.000
$A122$	-0.734	0.091	0.000	$A200$	-0.294	0.138	0.034

$A123$	-0.470	0.100	0.000	$A201$	-0.495	0.183	0.007
$A124$	-0.470	0.190	0.013	$A206$	1.686	0.397	0.000
$A125$	0.746	0.071	0.000	$A210$	-0.693	0.113	0.000
$A128$	0.831	0.043	0.000	$A211$	-0.393	0.104	0.000
$A130$	2.788	0.572	0.000	$A212$	1.609	0.121	0.000
$A131$	-0.835	0.066	0.000	$A213$	1.546	0.049	0.000
$A135$	1.355	0.559	0.015	$A214$	-0.575	0.050	0.000
$A136$	1.139	0.080	0.000	$A217$	0.629	0.149	0.000
$A137$	0.629	0.347	0.070	$A218$	0.159	0.037	0.000
$A139$	1.322	0.251	0.000	$A221$	1.476	0.227	0.000
$A141$	-0.208	0.059	0.000	$A222$	-0.208	0.057	0.000
$A143$	1.399	0.109	0.000	$A223$	0.693	0.100	0.000
$A144$	-0.421	0.074	0.000	$A224$	0.760	0.047	0.000
$A145$	1.566	0.377	0.000	$A225$	-0.208	0.116	0.074
$A146$	0.653	0.233	0.005	$A226$	1.075	0.349	0.002
$A148$	-0.329	0.033	0.000	$A230$	1.129	0.261	0.000
$art\,gen$	0.041	0.006	0.000	$public$	-0.288	0.017	0.000
k	9.070	0.036	0.000				
Obs.	5866						

Notes: Quantile regression for $q = 0.50$, using data from year 2 only. Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_2$. Robust standard error are reported. All results are rounded at the third digit.

Table B.5.3: Hedonic quantile model for $q = 0.5$ for year 3

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.431	0.141	0.002	$A141$	0.571	0.243	0.019
$A2$	0.345	0.060	0.000	$A142$	-0.705	0.337	0.037
$A3$	0.767	0.276	0.005	$A143$	0.804	0.442	0.069
$A6$	-0.551	0.079	0.000	$A144$	-0.584	0.148	0.000
$A11$	-0.194	0.067	0.004	$A147$	0.325	0.164	0.048
$A14$	-0.956	0.119	0.000	$A148$	-0.365	0.201	0.069
$A16$	1.124	0.056	0.000	$A151$	-0.665	0.064	0.000
$A24$	-0.956	0.052	0.000	$A153$	-0.591	0.213	0.005
$A25$	-0.611	0.109	0.000	$A156$	0.325	0.028	0.000
$A28$	-0.511	0.149	0.001	$A157$	0.995	0.198	0.000
$A100$	-0.531	0.055	0.000	$A161$	-0.754	0.179	0.000
$A101$	-0.560	0.145	0.000	$A163$	0.431	0.256	0.093
$A104$	-0.658	0.343	0.055	$A164$	-0.434	0.247	0.080
$A108$	1.306	0.403	0.001	$A166$	-0.531	0.077	0.000
$A111$	-0.348	0.192	0.069	$A167$	-0.560	0.142	0.000
$A112$	1.258	0.270	0.000	$A168$	-0.425	0.196	0.030
$A113$	0.190	0.048	0.000	$A171$	0.693	0.144	0.000

$A114$	-0.867	0.051	0.000	$A172$	-0.754	0.219	0.001
$A115$	-0.754	0.148	0.000	$A175$	0.423	0.041	0.000
$A116$	0.423	0.233	0.069	$A183$	1.019	0.201	0.000
$A118$	-0.754	0.254	0.003	$A187$	-0.879	0.085	0.000
$A120$	-0.348	0.128	0.006	$A190$	-0.658	0.064	0.000
$A122$	-1.025	0.036	0.000	$A191$	-0.223	0.074	0.003
$A123$	-0.754	0.230	0.001	$A197$	-0.348	0.079	0.000
$A125$	0.452	0.164	0.006	$A201$	-0.732	0.043	0.000
$A127$	-0.593	0.075	0.000	$A208$	-0.779	0.195	0.000
$A128$	-0.859	0.185	0.000	$A209$	-0.491	0.095	0.000
$A130$	2.377	0.693	0.001	$A210$	-0.382	0.208	0.066
$A131$	-0.668	0.208	0.001	$A211$	-0.531	0.117	0.000
$A132$	-0.946	0.245	0.000	$A212$	1.421	0.088	0.000
$A135$	2.050	0.068	0.000	$A213$	0.848	0.367	0.021
$A136$	0.951	0.144	0.000	$A219$	0.277	0.057	0.000
$A139$	1.118	0.047	0.000	$A223$	0.654	0.140	0.000
$art\,gen$	0.049	0.009	0.000	$public$	-0.425	0.032	0.000
k	9.230	0.054	0.000				
Obs.	3754						

Notes: Quantile regression for $q = 0.50$, using data from year 3 only. Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_3$. Robust standard error are reported. All results are rounded at the third digit.

Table B.5.4: Hedonic quantile model for $q = 0.5$ for year 4

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.466	0.151	0.002	$A151$	-0.425	0.233	0.069
$A2$	0.581	0.150	0.000	$A152$	-0.570	0.195	0.004
$A3$	0.907	0.422	0.032	$A153$	-0.956	0.177	0.000
$A4$	-0.959	0.086	0.000	$A154$	-0.898	0.203	0.000
$A5$	0.219	0.200	0.274	$A155$	-0.100	0.287	0.728
$A6$	-0.233	0.536	0.663	$A156$	-0.081	0.265	0.760
$A7$	-0.662	0.207	0.001	$A157$	1.344	0.477	0.005
$A8$	1.092	0.610	0.074	$A158$	1.130	0.282	0.000
$A9$	-1.081	0.599	0.071	$A159$	-0.323	0.200	0.106
$A10$	0.526	0.470	0.263	$A160$	-0.072	0.600	0.905
$A11$	0.109	0.195	0.577	$A161$	-0.227	0.246	0.356
$A12$	-0.698	0.137	0.000	$A162$	0.018	0.187	0.924
$A13$	-0.743	0.121	0.000	$A163$	0.755	0.258	0.003
$A14$	-0.762	0.166	0.000	$A164$	0.743	0.524	0.156
$A15$	0.650	0.185	0.000	$A165$	-0.401	0.311	0.197
$A16$	0.755	0.925	0.415	$A166$	-0.550	0.176	0.002
$A17$	0.841	0.355	0.018	$A167$	-0.776	0.140	0.000

$A18$	-0.364	0.152	0.017	$A168$	-0.264	0.112	0.018
$A19$	0.115	0.048	0.016	$A169$	-0.219	0.111	0.048
$A20$	-0.657	0.365	0.072	$A170$	-0.355	0.118	0.003
$A21$	0.478	0.155	0.002	$A171$	0.363	0.241	0.132
$A22$	-0.388	0.131	0.003	$A172$	-0.721	0.185	0.000
$A23$	-0.447	0.341	0.190	$A173$	0.650	0.420	0.122
$A24$	-0.793	0.161	0.000	$A174$	0.833	0.377	0.027
$A25$	-0.087	0.054	0.104	$A175$	0.601	0.527	0.254
$A26$	0.587	0.543	0.280	$A176$	-0.681	0.227	0.003
$A27$	-0.448	0.096	0.000	$A177$	0.340	0.293	0.246
$A28$	-0.475	0.203	0.019	$A178$	1.030	0.299	0.001
$A29$	1.498	0.656	0.022	$A179$	-1.064	0.234	0.000
$A100$	-0.818	0.129	0.000	$A180$	-0.553	0.133	0.000
$A101$	-0.793	0.048	0.000	$A181$	0.219	0.416	0.600
$A102$	-0.256	0.101	0.011	$A182$	-0.003	0.556	0.996
$A103$	-0.574	0.262	0.029	$A183$	1.515	0.517	0.003
$A104$	-1.120	0.040	0.000	$A184$	0.380	0.434	0.381
$A105$	-0.471	0.121	0.000	$A185$	-0.839	0.264	0.001
$A106$	0.652	0.461	0.157	$A186$	-0.590	0.235	0.012
$A107$	0.115	0.368	0.755	$A187$	-0.861	0.148	0.000
$A108$	1.498	0.425	0.000	$A188$	0.461	0.186	0.013
$A109$	0.529	0.331	0.110	$A189$	-0.051	0.160	0.751
$A110$	-0.530	0.371	0.153	$A190$	-0.776	0.137	0.000
$A111$	-0.662	0.736	0.369	$A191$	-0.474	0.227	0.037
$A112$	3.432	0.100	0.000	$A192$	-0.081	0.160	0.613
$A113$	0.208	0.782	0.790	$A193$	-0.449	0.125	0.000
$A114$	-0.408	0.293	0.163	$A194$	-0.126	0.241	0.601
$A115$	-0.793	0.099	0.000	$A195$	0.679	0.369	0.066
$A116$	0.408	0.314	0.194	$A196$	-0.074	0.108	0.495
$A117$	0.989	0.634	0.119	$A197$	-0.233	0.733	0.750
$A118$	-0.584	0.117	0.000	$A198$	-0.388	0.284	0.173
$A119$	-0.205	0.094	0.030	$A199$	-0.253	0.417	0.543
$A120$	-0.317	0.206	0.124	$A200$	0.043	0.474	0.928
$A121$	0.065	0.150	0.665	$A201$	-0.426	0.096	0.000
$A122$	-0.956	0.098	0.000	$A202$	-0.205	0.128	0.108
$A123$	-0.100	0.547	0.855	$A203$	-0.083	0.836	0.921
$A124$	-0.584	0.187	0.002	$A204$	0.653	0.474	0.168
$A125$	-0.003	0.186	0.988	$A205$	0.325	0.370	0.380
$A126$	0.037	0.599	0.950	$A206$	0.650	0.137	0.000
$A127$	-0.776	0.587	0.186	$A207$	-0.655	0.110	0.000
$A128$	-0.377	0.277	0.173	$A208$	-0.776	0.237	0.001
$A129$	-0.294	0.130	0.023	$A209$	-0.182	0.177	0.305
$A130$	2.176	0.402	0.000	$A210$	-0.956	0.178	0.000
$A131$	-0.570	0.651	0.381	$A211$	-0.316	0.204	0.122
$A132$	-1.081	0.055	0.000	$A212$	0.816	0.994	0.411
$A133$	0.660	0.323	0.041	$A213$	0.677	0.113	0.000
$A134$	0.325	0.392	0.407	$A214$	0.106	0.256	0.680

$A135$	1.345	0.481	0.005	$A215$	-0.320	0.198	0.106
$A136$	1.069	0.163	0.000	$A216$	-0.568	0.147	0.000
$A137$	-0.668	0.321	0.038	$A217$	0.689	0.466	0.140
$A138$	1.261	0.408	0.002	$A218$	-0.100	0.165	0.546
$A139$	1.161	0.282	0.000	$A219$	0.529	0.409	0.196
$A140$	-0.357	0.254	0.160	$A220$	-0.698	0.335	0.037
$A141$	-0.763	0.351	0.030	$A221$	1.044	0.227	0.000
$A142$	-0.203	0.444	0.648	$A222$	-0.744	0.113	0.000
$A143$	1.270	0.131	0.000	$A223$	0.771	0.206	0.000
$A144$	-0.662	0.151	0.000	$A224$	0.071	0.219	0.745
$A145$	0.208	0.080	0.009	$A225$	-0.319	0.140	0.022
$A146$	0.076	0.675	0.910	$A226$	0.297	0.731	0.685
$A147$	-0.222	0.305	0.466	$A227$	-0.248	0.326	0.447
$A148$	-0.285	0.174	0.102	$A228$	0.466	0.205	0.023
$A149$	0.851	0.192	0.000	$A229$	-0.513	0.345	0.137
$A150$	0.123	0.269	0.647	$A230$	0.990	0.361	0.006
$art\,gen$	0.092	0.018	0.000	$public$	-0.295	0.071	0.000
k	9.016	0.087	0.000	$share_4$	-0.618	0.473	0.191
Obs.	3795						

Notes: Quantile regression for $q = 0.50$, using data from year 4 only. Coefficients and standard errors are obtained through bootstrap technique. Only variables statistically different from 0 with confidence level at 0.90 are reported. Covariates used in the full model: $art\,genre$, $public$, $share_4$. All results are rounded at the third digit.

Table B.5.5: Hedonic quantile model for $q = 0.5$ for year 5

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A1$	0.247	0.174	0.156	$A151$	-1.059	0.098	0.000
$A2$	0.531	0.088	0.000	$A152$	-0.692	0.266	0.009
$A3$	1.099	0.360	0.002	$A153$	-1.044	0.115	0.000
$A4$	-0.629	0.142	0.000	$A154$	-0.812	0.172	0.000
$A5$	-0.045	0.230	0.846	$A155$	-0.120	0.266	0.653
$A6$	-0.817	0.121	0.000	$A156$	-0.118	0.161	0.463
$A7$	-1.218	0.229	0.000	$A157$	-0.417	1.038	0.688
$A8$	0.758	0.656	0.248	$A158$	0.065	0.599	0.914
$A9$	-1.139	0.159	0.000	$A159$	-0.243	0.264	0.358
$A10$	-0.148	0.123	0.230	$A160$	-0.165	0.195	0.397
$A11$	-0.321	0.131	0.014	$A161$	-1.131	0.198	0.000
$A12$	-1.139	0.069	0.000	$A162$	0.003	0.386	0.994
$A13$	-0.641	0.124	0.000	$A163$	0.288	0.183	0.117
$A14$	-1.139	0.153	0.000	$A164$	0.470	0.154	0.002
$A15$	0.132	0.307	0.667	$A165$	-0.375	0.342	0.273
$A16$	1.504	0.194	0.000	$A166$	-1.107	0.718	0.123
$A17$	0.346	0.208	0.096	$A167$	-0.722	0.293	0.014

$A18$	-0.996	0.095	0.000	$A168$	-0.366	0.154	0.018
$A19$	-1.036	1.787	0.562	$A169$	-0.098	0.417	0.814
$A20$	-0.616	0.114	0.000	$A170$	-0.158	0.351	0.653
$A21$	-0.249	0.150	0.097	$A171$	0.362	0.138	0.009
$A22$	-0.588	0.302	0.051	$A172$	-1.098	0.084	0.000
$A23$	-0.746	0.392	0.057	$A173$	-0.172	0.336	0.608
$A24$	-1.281	0.083	0.000	$A174$	-0.711	0.439	0.106
$A25$	0.068	0.158	0.664	$A175$	0.396	0.308	0.198
$A26$	0.644	0.940	0.494	$A176$	-0.029	0.218	0.896
$A27$	-0.496	0.245	0.043	$A177$	0.392	0.312	0.209
$A28$	-0.351	0.072	0.000	$A178$	0.685	0.464	0.140
$A29$	-0.362	0.257	0.160	$A179$	-0.877	0.292	0.003
$A100$	-0.803	0.129	0.000	$A180$	-1.057	0.105	0.000
$A101$	-0.919	0.078	0.000	$A181$	0.003	0.128	0.983
$A102$	0.894	0.469	0.057	$A182$	-0.467	0.089	0.000
$A103$	-0.179	0.126	0.154	$A183$	2.030	0.188	0.000
$A104$	-0.262	0.211	0.215	$A184$	-0.706	0.407	0.083
$A105$	-0.712	0.203	0.000	$A185$	-0.241	0.381	0.526
$A106$	0.101	0.315	0.750	$A186$	-0.184	0.063	0.003
$A107$	0.401	0.688	0.560	$A187$	-0.852	0.099	0.000
$A108$	0.776	0.147	0.000	$A188$	0.470	0.126	0.000
$A109$	-0.315	0.214	0.140	$A189$	-0.943	0.048	0.000
$A110$	-0.210	0.376	0.576	$A190$	-0.589	0.269	0.029
$A111$	-0.469	0.396	0.236	$A192$	-0.002	0.315	0.996
$A112$	1.044	1.489	0.483	$A193$	-0.370	0.214	0.084
$A113$	-0.294	0.334	0.379	$A194$	-0.292	0.215	0.175
$A114$	-0.852	0.189	0.000	$A195$	0.065	0.477	0.892
$A115$	-1.224	0.073	0.000	$A196$	-0.362	0.103	0.000
$A116$	0.801	0.426	0.060	$A197$	0.104	0.170	0.539
$A117$	-0.079	0.373	0.832	$A198$	-0.496	0.166	0.003
$A118$	-0.962	0.141	0.000	$A199$	0.988	0.582	0.090
$A119$	0.736	0.818	0.369	$A200$	-0.792	0.396	0.046
$A120$	-0.375	0.198	0.058	$A201$	-0.629	0.187	0.001
$A121$	-0.353	0.196	0.071	$A202$	-0.703	0.075	0.000
$A122$	-1.188	0.242	0.000	$A203$	-0.910	0.063	0.000
$A123$	-1.059	0.067	0.000	$A204$	0.630	0.376	0.094
$A124$	-0.957	0.110	0.000	$A205$	0.512	0.641	0.425
$A125$	0.053	0.277	0.848	$A206$	0.692	0.208	0.001
$A126$	-0.236	0.488	0.629	$A207$	0.304	0.616	0.622
$A127$	-0.446	0.659	0.498	$A208$	-0.877	0.255	0.001
$A128$	-0.365	0.134	0.007	$A209$	-0.400	0.217	0.066
$A129$	-0.446	0.219	0.041	$A210$	-0.629	0.197	0.001
$A130$	2.579	0.514	0.000	$A211$	-0.709	0.296	0.017
$A131$	-0.399	0.586	0.496	$A212$	0.788	0.574	0.170
$A132$	-0.957	0.514	0.063	$A213$	0.797	0.122	0.000
$A133$	-0.758	0.250	0.002	$A214$	-0.366	0.571	0.522
$A134$	0.228	0.654	0.727	$A215$	-0.494	0.386	0.200

$A135$	0.283	0.299	0.343	$A216$	-0.366	0.258	0.155
$A136$	1.021	0.441	0.021	$A217$	0.856	0.227	0.000
$A137$	-0.362	0.260	0.165	$A218$	-0.366	0.123	0.003
$A138$	-0.353	0.389	0.364	$A219$	0.382	0.659	0.562
$A139$	0.514	0.628	0.413	$A220$	-1.139	0.209	0.000
$A140$	-0.940	0.195	0.000	$A221$	0.327	0.232	0.158
$A141$	-0.525	0.236	0.026	$A222$	-0.852	0.190	0.000
$A142$	-0.295	0.403	0.464	$A223$	0.997	0.307	0.001
$A143$	1.207	0.181	0.000	$A224$	0.226	0.247	0.361
$A144$	-0.629	0.178	0.000	$A225$	-0.629	0.257	0.015
$A145$	0.970	1.222	0.427	$A226$	-0.446	0.413	0.280
$A146$	-0.653	0.607	0.282	$A227$	-0.366	0.510	0.472
$A147$	-0.061	0.289	0.833	$A228$	0.247	0.349	0.479
$A148$	-0.678	0.343	0.048	$A229$	-1.416	0.160	0.000
$A149$	0.803	0.481	0.095	$A230$	-0.120	0.427	0.779
$A150$	-0.366	0.307	0.233	$share_5$	-0.610	0.463	0.188
$art\,gen$	0.023	0.010	0.024	$public$	-0.342	0.056	0.000
k	9.460	0.050	0.000				
Obs.	3578						

Notes: Quantile regression for $q = 0.50$, using data from year 5 only. Coefficients and standard errors are obtained through bootstrap technique. Only variables statistically different from 0 with confidence level at 0.90 are reported. Covariates used in the full model: $art\,genre$, $public$, $share_5$. Robust standard error are reported. All results are rounded at the third digit.

Table B.5.6: Hedonic quantile model for $q = 0.5$ for year 6

	Coeff.	St. Er.	p-val		Coeff.	St. Er.	p-val
$A2$	0.543	0.067	0.000	$A152$	-1.009	0.236	0.000
$A3$	1.161	0.142	0.000	$A153$	-0.916	0.080	0.000
$A11$	-0.439	0.061	0.000	$A155$	-0.404	0.105	0.000
$A12$	-0.923	0.430	0.032	$A159$	-0.251	0.065	0.000
$A13$	-0.771	0.225	0.001	$A162$	0.302	0.042	0.000
$A14$	-0.911	0.136	0.000	$A165$	-0.916	0.398	0.021
$A16$	2.003	0.482	0.000	$A168$	-0.405	0.071	0.000
$A18$	-0.915	0.039	0.000	$A169$	-0.397	0.061	0.000
$A21$	-0.203	0.036	0.000	$A170$	-0.318	0.144	0.027
$A24$	-1.225	0.144	0.000	$A172$	-0.836	0.049	0.000
$A101$	-0.821	0.119	0.000	$A174$	-0.821	0.101	0.000
$A105$	-0.504	0.061	0.000	$A176$	-0.396	0.103	0.000
$A108$	1.086	0.072	0.000	$A178$	0.394	0.218	0.071
$A110$	-0.769	0.028	0.000	$A179$	-0.916	0.083	0.000
$A111$	-0.965	0.076	0.000	$A180$	-0.760	0.100	0.000
$A112$	3.267	0.102	0.000	$A187$	-0.853	0.147	0.000

$A115$	-0.821	0.041	0.000	$A189$	-0.916	0.230	0.000
$A118$	-0.898	0.148	0.000	$A190$	-0.382	0.164	0.020
$A119$	1.695	0.158	0.000	$A195$	0.504	0.113	0.000
$A120$	-0.405	0.062	0.000	$A196$	-0.296	0.093	0.002
$A121$	-0.310	0.153	0.043	$A197$	0.759	0.427	0.075
$A122$	-1.093	0.195	0.000	$A201$	-0.636	0.122	0.000
$A124$	-0.762	0.283	0.007	$A202$	-0.274	0.105	0.009
$A127$	-0.942	0.230	0.000	$A203$	0.104	0.033	0.001
$A129$	-0.251	0.136	0.065	$A204$	0.688	0.073	0.000
$A130$	1.540	0.185	0.000	$A205$	0.504	0.156	0.001
$A136$	1.381	0.422	0.001	$A206$	1.100	0.077	0.000
$A138$	-0.413	0.137	0.003	$A209$	-0.405	0.107	0.000
$A140$	-0.537	0.065	0.000	$A212$	1.378	0.408	0.001
$A143$	0.941	0.397	0.018	$A213$	0.822	0.298	0.006
$A144$	-0.728	0.150	0.000	$A215$	-0.670	0.068	0.000
$A145$	0.655	0.272	0.016	$A217$	0.988	0.069	0.000
$A146$	1.299	0.187	0.000	$A219$	0.649	0.318	0.041
$A148$	-0.404	0.139	0.004	$A221$	1.289	0.074	0.000
$A149$	1.401	0.297	0.000	$A222$	-0.708	0.132	0.000
$A150$	-0.919	0.213	0.000	$A223$	0.855	0.317	0.007
$A151$	-0.921	0.196	0.000	$public$	-0.407	0.046	0.000
$art\,gen$	0.068	0.013	0.000	$share_6$	-1.896	0.370	0.000
k	9.287	0.062	0.000				
Obs.	5866						

Notes: Quantile regression for $q = 0.50$, using data from year 6 only. Stepwise regression results, with backward elimination of the coefficients not significant at 0.10. Covariates used in the full model: $art\,genre$, $public$, $share_6$. Robust standard error are reported. All results are rounded at the third digit.

References

Adler, M. (1985), 'Stardom and talent', *The American Economic Review* **75**(1), 208–212.

Adler, M. (2006), Stardom and talent, *in* V. A. Ginsburgh and D. Throsby, eds, 'Handbook of the Economics of Art and Culture', Vol. 1, Amsterdam: Elsevier, pp. 895–906.

Agnello, R. J. and Pierce, R. K. (1996), 'Financial returns, price determinants, and genre effects in American art investment', *Journal of Cultural Economics* **20**(4), 359–383.

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

Anderson, R. C. (1974), 'Paintings as an investment', *Economic Inquiry* **12**(1), 13–26.

Angelini, F. (2012), 'Le aste online: Le vendite in Italia di arte visiva su eBay', *Sistemaeconomico* **2010**(1), 5–20.

Arnold, M. A. and Lippman, S. A. (1998), 'Posted prices versus bargaining in markets with asymmetric information', *Economic Inquiry* **36**(3), 450–457.

Ashenfelter, O. (1989), 'How auctions work for wine and art', *The Journal of Economic Perspectives* **3**(3), 23–36.

Ashenfelter, O. and Graddy, K. (2003), 'Auctions and the price of art', *Journal of Economic Literature* **41**(3), 763–786.

Baumol, W. J. (1986), 'Unnatural value: Or art investment as floating crap game', *The American Economic Review* **76**(2), 10–14.

Baumol, W. J. and Throsby, D. (2012), 'Psychic payoffs, overpriced assets, and underpaid superstars', *Kyklos* **65**(3), 313–326.

Becker, G. S. and Murphy, K. M. (1988), 'A theory of rational addiction', *Journal of Political Economy* **96**(4), 675–700.

Beckert, J. and Rössel, J. (2004), 'Art and prices. Reputation as a mechanism for reducing uncertainty in the art market', *Kolner Zeitschrift fur Soziologie und Sozialpsychologie* **56**(1), 32–50.

Beckert, J. and Rössel, J. (2013), 'The price of art', *European Societies* **15**(2), 178–195.

Bell, D. E. (1985), 'Disappointment in decision making under uncertainty', *Operations Research* **33**(1), 1–27.

Benhamou, F., Moureau, N. and Sagot-duvauroux, D. (2002), 'Opening the black box of the white cube: A survey of French contemporary art galleries at the turn of the millenium', *Poetics* **30**(4), 263–280.

Blaug, M. (2001), 'Where are we now on cultural economics?', *Journal of Economic Surveys* **15**(2), 123–143.

Bonus, H. and Ronte, D. (1997), 'Credibility and economic value in the arts', *Journal of Cultural Economics* **21**(2), 103–118.

Bulow, J. and Klemperer, P. (1996), 'Auctions versus negotiations', *The American Economic Review* **86**(1), 180–194.

Bulow, J. and Klemperer, P. (2009), 'Why do sellers (usually) prefer auctions?', *The American Economic Review* **99**(4), 1544–1575.

Cagnone, S., Giannerini, S. and Modugno, L. (2016), Multilevel models with stochastic volatility for repeated cross-sections: An application to tribal art prices, ArXiv e-prints: `http://arxiv.org/abs/1603.01985`.

Cameron, S. (1995), 'On the role of critics in the culture industry', *Journal of Cultural Economics* **19**(4), 321–331.

Campbell, C. M. and Levin, D. (2006), 'When and why not to auction', *Economic Theory* **27**(3), 583–596.

Campbell, R. A. (2008), 'Art as a financial investment', *Journal of Alternative Investments* **10**, 64–81.

Campbell, R. A. (2009), Art as a financial investment, *in* S. Satchell, ed., 'Collectible Investments for the High Net Worth Investor', Burlington, MA: Academic Press, pp. 119–150.

Candela, G. and Castellani, M. (2000), 'L'economia e l'arte', *Economia Politica* **17**(3), 375–392.

Candela, G., Castellani, M. and Pattitoni, P. (2012), 'Tribal art market: Signs and signals', *Journal of Cultural Economics* **36**(4), 289–308.

Candela, G., Castellani, M. and Pattitoni, P. (2013), 'Reconsidering psychic return in art investments', *Economics Letters* **118**, 351–354.

Candela, G., Castellani, M. and Pattitoni, P. (forthcoming), 'The markup of modern and contemporary art galleries in Italy', *Rivista di Politica Economica* .

Candela, G., Castellani, M., Pattitoni, P. and Di Lascio, F. M. (2016), 'On Rosen's and Adler's hypotheses in the modern and contemporary visual art market', *Empirical Economics* **451**(1), 415–437.

Candela, G., Figini, P. and Scorcu, A. E. (2002), 'Hedonic prices in the art market: A reassessment', *Paper presented at the conference of the Association of Cultural Economics International, Rotterdam* .

Candela, G., Figini, P. and Scorcu, A. E. (2004), 'Price indices for artists - A proposal', *Journal of Cultural Economics* **28**, 285–302.

Candela, G., Lorusso, S. and Matteucci, C. (2009), 'Information, documentation and certification in Western and ethnic art', *Conservation Science in Cultural Heritage* **9**(1), 47–78.

Candela, G. and Scorcu, A. E. (2004), *Economia delle Arti*, Bologna: Zanichelli.

Caserta, M. and Cuccia, T. (2001), 'The supply of arts labour: Towards a dynamic approach', *Journal of Cultural Economics* **25**, 185–201.

Cason, T. N., Friedman, D. and Milam, G. H. (2003), 'Bargaining versus posted price competition in customer markets', *International Journal of Industrial Organization* **21**(2), 223–251.

Caves, R. E. (2000), *Creative industries: Contracts between art and commerce*, Cambridge, MA: Harvard University Press.

Caves, R. E. (2003), 'Contracts between art and commerce', *The Journal of Economic Perspectives* **17**(2), 73–84.

Cellini, R. and Cuccia, T. (2014), 'The artist–art dealer relationship as a marketing channel', *Research in Economics* **68**(1), 57–69.

Champarnaud, L. (2014), 'Prices for superstars can flatten out', *Journal of Cultural Economics* **38**(4), 369–384.

Champarnaud, L., Ginsburgh, V. A. and Michel, P. (2008), 'Can public arts education replace arts subsidization?', *Journal of Cultural Economics* **32**(2), 109–126.

Chanel, O. (1995), 'Is art market behaviour predictable?', *European Economic Review* **39**(3-4), 519–527.

Chanel, O., Gérard-Varet, L.-A. and Ginsburgh, V. A. (1996), 'The relevance of hedonic price indices: The case of paintings', *Journal of Cultural Economics* **20**, 1–24.

Chossat, V. and Gergaud, O. (2003), 'Expert opinion and gastronomy: The recipe for success', *Journal of Cultural Economics* **27**(2), 127–141.

Chow, Y. L., Hafalir, I. E. and Yavas, A. (2015), 'Auction versus negotiated sale: Evidence from real estate sales', *Real Estate Economics* **43**(2), 432–470.

Chung, K. H. and Cox, R. A. K. (1994), 'A stochastic model of superstardom: An application of the Yule distribution', *The Review of Economics and Statistics* **76**(4), 771–775.

Collins, A., Scorcu, A. E. and Zanola, R. (2009), 'Reconsidering hedonic art price indexes', *Economics Letters* **104**(2), 57–60.

Cox, R. A. K. and Felton, J. M. (1995), 'The concentration of commercial success in popular music: An analysis of the distribution of Gold records', *Journal of Cultural Economics* **19**, 333–340.

Crain, W. M. and Tollison, R. D. (2002), 'Consumer choice and the popular music industry: A test of the superstar theory', *Empirica* **29**(1), 1–9.

Cuccia, T. and Cellini, R. (2009), 'Workers' enterprises and the taste for production: The arts, sport and other cases', *Scottish Journal of Political Economy* **56**(1), 123–137.

Darby, M. R. and Karni, E. (1973), 'Free competition and the optimal amount of fraud', *The Journal of Law & Economics* **16**(1), 67–88.

De Marchi, N. (2008), Confluence of value: Three historical moments, *in* M. Hutter and D. Throsby, eds, 'Beyond Price', New York, NY: Cambridge University Press, pp. 200–219.

Dekker, E. (2014), 'Two approaches to study the value of art and culture, and the emergence of a third', *Journal of Cultural Economics* **39**(4), 309–326.

Dulleck, U., Johnston, D. W., Kerschbamer, R. and Sutter, M. (2012), The good, the bad and the naive: Do fair prices signal good types or do they induce good behaviour?, IZA Discussion Paper No. 6491.

Dulleck, U. and Kerschbamer, R. (2006), 'On doctors, mechanics, and computer specialists: The economics of credence goods', *Journal of Economic literature* **44**(1), 5–42.

Dulleck, U. and Kerschbamer, R. (2009), 'Experts vs. discounters: Consumer free-riding and experts withholding advice in markets for credence goods', *International Journal of Industrial Organization* **27**(1), 15–23.

Dulleck, U., Kerschbamer, R. and Sutter, M. (2011), 'The economics of credence goods: An experiment on the role of liability, verifiability, reputation, and competition', *The American Economic Review* **101**(2), 526–555.

Ehrmann, T., Meiseberg, B. and Ritz, C. (2009), 'Superstar effects in deluxe gastronomy - An empirical analysis of value creation in German quality restaurants', *Kyklos* **62**(4), 526–541.

Emons, W. (1997), 'Credence goods and fraudulent experts', *The RAND Journal of Economics* **28**(1), 107–119.

Emons, W. (2001), 'Credence goods monopolists', *International Journal of Industrial Organization* **19**(3-4), 375–389.

Etro, F. and Pagani, L. (2013), 'The market for paintings in the Venetian Republic from Renaissance to Rococò', *Journal of Cultural Economics* **37**(4), 391–415.

Filimon, N., López-Sintas, J. and Padrós-Reig, C. (2011), 'A test of Rosen's and Adler's theories of superstars', *Journal of Cultural Economics* **35**(2), 137–161.

Flôres, R. G. J., Ginsburgh, V. A. and Jeanfils, P. (1999), 'Long- and short-term portfolio choices of paintings', *Journal of Cultural Economics* **23**(3), 191–208.

Fox, M. A. and Kochanowski, P. (2004), 'Models of superstardom: An application of the Lotka and Yule distributions', *Popular Music and Society* **27**(4), 507–522.

Franck, E. and Nüesch, S. (2008), 'Mechanisms of superstar formation in German soccer: Empirical evidence', *European Sport Management Quarterly* **8**(2), 145–164.

Franck, E. and Nüesch, S. (2012), 'Talent and/or popularity: What does it take to be a superstar?', *Economic Inquiry* **50**(1), 202–216.

Georges, P. and Seçkin, A. (2013), 'Black notes and white noise: A hedonic approach to auction prices of classical music manuscripts', *Journal of Cultural Economics* **37**(1), 33–60.

Ginsburgh, V. A. (2003), 'Awards, success and aesthetic quality in the arts', *Journal of Economic Perspectives* **17**(2), 99–111.

Ginsburgh, V. A. and Jeanfils, P. (1995), 'Long-term comovements in international markets for paintings', *European Economic Review* **39**(3-4), 538–548.

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

Ginsburgh, V. A. and Weyers, S. (1999), 'On the perceived quality of movies', *Journal of Cultural Economics* **23**(1), 269–283.

Ginsburgh, V. A. and Weyers, S. (2008), Quantitative approach to valuation in the arts, with an application to movies, *in* M. Hutter and D. Throsby, eds, 'Beyond Price', New York, NY: Cambridge University Press, pp. 179–199.

Graddy, K. and Hamilton, J. (2014), Auction house guarantees for works of art, CEPR Discussion Papers No. 9996.

Grant, D. (2013), How to haggle for art, Retrieved at: `http://www.wsj.com/articles/sb10001424127887324009304579043172964729330`, February 12, 2016.

Graw, I. (2012), In the grip of the market? On the relative heteronomy of art, the art world, and art criticism, *in* M. Lind and O. Velthuis, eds, 'Contemporary Art and its Commercial Markets', Berlin: Sternberg Press, pp. 183–207.

Greenfeld, L. (1988), 'Professional ideologies and patterns of "gatekeeping": Evaluation and judgment within two art worlds', *Social Forces* **66**(4), 903–925.

Hagiu, A. and Yoffie, D. B. (2013), 'The new patent intermediaries: Platforms, defensive aggregators, and super-aggregators', *Journal of Economic Perspectives* **27**(1), 45–66.

Hamlen, W. A. J. (1991), 'Superstardom in popular music: Empirical evidence', *The Review of Economics and Statistics* **73**(4), 729–733.

Hamlen, W. A. J. (1994), 'Variety and superstardom in popular music', *Economic Inquiry* **32**(3), 395–406.

Hammond, R. G. (2010), 'Comparing revenue from auctions and posted prices', *International Journal of Industrial Organization* **28**(1), 1–9.

Hellmanzik, C. (2009), 'Artistic styles: Revisiting the analysis of modern artists' careers', *Journal of Cultural Economics* **33**(3), 201–232.

Hernando Calero, E. and Campo Martínez, S. (2016), Perceived value of works of art: Development of measurement scale, Mimeo, Available at: http://eventos.uva.es/file_manager/get_paper/4030.

Hess, T. B. (1958), 'Is todays artist with or against the past?', *Artnews* **57**(4).

Higgins, C. (2016), Orwellian nightmare or fairer system for all? What Quality Metrics will mean for arts funding, Retrieved at: https://www.theguardian.com/culture/2016/oct/04/quality-metrics-arts-council-england-funding, October 12, 2016.

Hodges, J. (2015), Art you can own but not have, Retrieved at: http://www.wsj.com/articles/art-you-can-own-but-not-have-1425870182, October 4, 2016.

Hutter, M. and Frey, B. S. (2010), 'On the influence of cultural value on economic value', *Revue d'économie politique* **120**(1), 35–46.

Hutter, M., Knebel, C., Pietzner, G. and Schäfer, M. (2007), 'Two games in town: A comparison of dealer and auction prices in contemporary visual arts markets', *Journal of Cultural Economics* **31**(4), 247–261.

Hutter, M. and Shusterman, R. (2006), Value and the valuation of art in economic and aesthetic theory, *in* V. A. Ginsburgh and D. Throsby, eds, 'Handbook of the Economics of Art and Culture', Vol. 1, Amsterdam: Elsevier, pp. 169–208.

Hutter, M. and Throsby, D., eds (2008), *Beyond price: Value in culture, economics, and the art*, New York: Cambridge University Press.

Hyndman, K. and Ozerturk, S. (2011), 'Consumer information in a market for expert services', *Journal of Economic Behavior & Organization* **80**(3), 628–640.

Kawashima, N. (1999), 'Distribution of the arts: British arts centres as gatekeepers' in intersecting cultural production systems', *Poetics* **26**(4), 263–283.

Khaire, M. (2015), Art without borders? Online firms and the global art market, *in* O. Velthuis and S. Baia Curioni, eds, 'Cosmopolitan Canvases: The Globalization of Markets for Contemporary Art', Oxford: Oxford University Press, pp. 102–126.

Kinsella, E. (2016*a*), Artnet News names the 100 most collectible living artists, Retrieved at: `https://news.artnet.com/market/artnet-news-100-most-collectible-artists-717251`, November 25, 2016.

Kinsella, E. (2016*b*), What does TEFAF 2016 Art Market report tell us about the global art trade?, Retrieved at: `https://news.artnet.com/market/tefaf-2016-art-market-report-443615`, October 10, 2016.

Klamer, A. (2004), Cultural goods are good for more than their economic value, *in* V. Rao and M. Walton, eds, 'Culture and Public Action', Stanford, CA: Stanford University Press, pp. 138–162.

Klamer, A. (2008), The lives of cultural goods, *in* J. Amariglio, J. W. Childers and S. E. Cullenberg, eds, 'Sublime Economy: On the Intersection of Art and Economics', London: Routledge, pp. 250–272.

Klamer, A., ed. (1996), *The Value of Culture*, Amsterdam: Amsterdam University Press.

Koenker, R. W. and Bassett, G. (1978), 'Regression quantiles', *Econometrica* **46**(1), 33–50.

Koenker, R. W. and Hallock, K. F. (2001), 'Quantile regression', *Journal of Economic Perspectives* **15**(4), 143–156.

Kräussl, R., Lehnert, T. and Martelin, N. (2016), 'Is there a bubble in the art market?', *Journal of Empirical Finance* **35**, 99–109.

Kultti, K. (1999), 'Equivalence of auctions and posted prices', *Games and Economic Behavior* **27**(1), 106–113.

Lancaster, K. J. (1966), 'A new approach to consumer theory', *The Journal of Political Economy* **74**(2), 132–157.

Lehmann, E. E. and Schulze, G. G. (2008), 'What does it take to be a star? The role of performance and the media for German soccer players', *Applied Economics Quarterly* **54**(1), 59–70.

Lind, M. and Velthuis, O., eds (2012), *Contemporary Art and its Commercial Markets*, Berlin: Sternberg Press.

Locatelli Biey, M. and Zanola, R. (2005), 'The market for Picasso prints: A hybrid model approach', *Journal of Cultural Economics* **29**(2), 127–136.

Loomes, G. and Sugden, R. (1986), 'Disappointment and dynamic consistency in choice under uncertainty', *The Review of Economic Studies* **53**(2), 271–282.

Lu, X. and McAfee, R. P. (1996), 'The evolutionary stability of auctions over bargaining', *Games and Economic Behavior* **15**(2), 228–254.

Lucifora, C. and Simmons, R. (2003), 'Superstar effects in sport: Evidence from Italian soccer', *Journal Of Sports Economics* **4**(1), 35–55.

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

MacDonald, G. M. (1988), 'The economics of rising stars', *The American Economic Review* **78**(1), 155–166.

Mandel, B. R. (2009), 'Art as an investment and conspicuous consumption good', *The American Economic Review* **99**(4), 1653–1663.

McAndrew, C. (2014), The TEFAF art market report 2014. The global art market with a focus on the US and China, Maastricht: The European Fine Art Foundation.

McCain, R. A. (1980), Markets for works of art and "Markets for lemons", *in* W. S. Hendon, J. L. Shanahan and A. J. MacDonald, eds, 'Economic Policy for the Arts', Cambridge, MA: Abt Books, pp. 122–136.

McCain, R. A. (2006), Defining cultural and artistic goods, *in* V. A. Ginsburgh and D. Throsby, eds, 'Handbook of the Economics of Art and Culture', Vol. 1, Amsterdam: Elsevier, pp. 147–167.

Menger, P.-M. (2006), Artist labor markets: Contingent work, excess supply and occupational risk management, *in* V. A. Ginsburgh and D. Throsby, eds, 'Handbook of the Economics of Art and Culture', Vol. 1, Amsterdam: Elsevier, pp. 765–811.

Modugno, L., Cagnone, S. and Giannerini, S. (2015), 'A multilevel model with autoregressive components for the analysis of tribal art prices', *Journal of Applied Statistics* **42**(10), 2141–2158.

Muñiz Jr., A. M., Norris, T. and Fine, G. A. (2014), 'Marketing artistic careers: Pablo Picasso as brand manager', *European Journal of Marketing* **48**(1/2), 68–88.

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

NOMISMA (2013), Rapporto sul mercato dei beni artistici. Osservatorio sul mercato dei beni artistici, Bologna: NOMISMA.

Pesendorfer, W. and Wolinsky, A. (2003), 'Second opinions and price competition: Inefficiency in the market for expert advice', *Review of Economic Studies* **70**(2), 417–437.

Peterson, K. (1997), 'The distribution and dynamics of uncertainty in art galleries: A case study of new dealerships in the Parisian art market, 1985-1990', *Poetics* **25**(4), 241–263.

Pradier, P.-C., Gardes, F., Greffe, X. and Mendoza, I. M. (2016), 'Autographs and the global art market: The case of hedonic prices for French autographs (1960-2005)', *Journal of Cultural Economics* **40**(4), 453–485.

Pretz, L. (2016), Theories of superstardom: A critique and the groundwork for an alternative, Mimeo , Available at: `http://eventos.uva.es/file_manager/get_paper/6396`.

Quemin, A. and van Hest, F. (2015), The impact of nationality and territory on fame and success in the visual arts sector: Artists, experts, and the market, *in* O. Velthuis and S. Baia Curioni, eds, 'Cosmopolitan Canvases: The Globalization of Markets for Contemporary Art', Oxford: Oxford University Press, pp. 170–192.

Reinstein, D. A. and Snyder, C. M. (2005), 'The influence of expert reviews on consumer demand for experience goods: A case study of movie critics', *The Journal of Industrial Economics* **53**(1), 27–51.

Rengers, M. and Velthuis, O. (2002), 'Determinants of prices for contemporary art in Dutch galleries, 1992-1998', *Journal of Cultural Economics* **26**(1), 1–28.

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

Romer, M. (2016), Quality Metrics? Arts organisations need to wake up and smell the coffee... #artsfunding, Retrieved at: `http://bit.do/romer_quality_metrics`, October 12, 2016.

Rosen, S. (1974), 'Hedonic prices and implicit markets: Product differentiation in pure competition', *Journal of Political Economy* **82**(1), 34–55.

Rosen, S. (1981), 'The economics of superstars', *The American Economic Review* **71**(5), 845–858.

Rothschild, M. and Stiglitz, J. (1976), 'Equilibrium in competitive insurance markets: An essay on the economics of imperfect information', *The Quarterly Journal of Economics* **90**(4), 629–649.

Santagata, W. (1995), 'Institutional anomalies in the contemporary art market', *Journal of Cultural Economics* **19**, 187–197.

Schönfeld, S. and Reinstaller, A. (2007), 'The effects of gallery and artist reputation on prices in the primary market for art: A note', *Journal of Cultural Economics* **31**(2), 143–153.

Schroeder, J. E. (2005), 'The artist and the brand', *European Journal of Marketing* **39**(11/12), 1291–1305.

Schwartz, S. K. (2015), Wealthy investors dabble in art investment funds, Retrieved at: http://www.cnbc.com/2015/05/29/wealthy-investors-dabble-in-art-investment-funds.html, October 4, 2016.

Scorcu, A. E. and Zanola, R. (2011), 'The "right" price for art collectibles: A quantile hedonic regression investigation of Picasso paintings', *Journal of Alternative Investments* **14**(2), 89–99.

Shubik, M. (2003), Dealers in art, *in* R. Towse, ed., 'A Handbook of Cultural Economics', Cheltenham: Edward Elgar Publishing, pp. 194–200.

Smith, T. (2008), Creating value between cultures: Contemporary Australian aboriginal art, *in* M. Hutter and D. Throsby, eds, 'Beyond Price', New York, NY: Cambridge University Press, pp. 23–40.

Snowball, J. D. (2008), *Measuring the Value of Culture*, Berlin: Springer.

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

Spiegler, R. (2011), *Bounded Rationality and Industrial Organization*, Oxford: Oxford University Press.

Stigler, G. J. (1961), 'The economics of information', *Journal of Political Economy* **69**(3), 213–225.

Stigler, G. J. and Becker, G. S. (1977), 'De gustibus non est disputandum', *The American Economic Review* **67**(2), 76–90.

The Economist (2008), The Shark's last move, Retrieved at: http://www.economist.com/node/12202493, May 16, 2016.

Throsby, D. (1990), 'Perception of quality in demand for the theatre', *Journal of Cultural Economics* **14**(1), 65–82.

Throsby, D. (1994), 'The production and consumption of the arts: A view of cultural economics', *Journal of Economic Literature* **32**(1), 1–29.

Throsby, D. (2001), *Economics and culture*, Cambridge, UK: Cambridge University Press.

Throsby, D. (2003), 'Determining the value of cultural goods: How much (or how little) does contingent valuation tell us?', *Journal of Cultural Economics* **27**(3-4), 275–285.

Throsby, D. (2006), 'An artistic production function: Theory and an application to Australian visual arts', *Journal of Cultural Economics* **30**, 1–14.

Throsby, D. and Zednik, A. (2014), The economic and cultural value of paintings: Some empirical evidence, *in* V. A. Ginsburgh and D. Throsby, eds, 'Handbook of the Economics of Art and Culture', Vol. 2, Amsterdam: Elsevier, pp. 81–99.

Tobias, S. (2004), 'Quality in the performing arts: Aggregating and rationalizing expert opinion', *Journal of Cultural Economics* **28**(2), 109–124.

Towse, R. (1996), Market value and artists' earnings, *in* A. Klamer, ed., 'The Value of Culture', Amsterdam: Amsterdam University Press, pp. 96–107.

Towse, R. (2006), Human capital and artists' labour market, *in* V. A. Ginsburgh and D. Throsby, eds, 'Handbook of the Economics of Art and Culture', Vol. 1, Amsterdam: Elsevier, pp. 865–894.

Ursprung, H. W. and Wiermann, C. (2011), 'Reputation, price, and death: An empirical analysis of art price formation', *Economic Inquiry* **49**(3), 697–715.

Van den Braembussche, A. (1996), The value of art: A philosophical perspective, *in* A. Klamer, ed., 'The Value of Culture', Amsterdam: Amsterdam University Press, pp. 31–43.

Velthuis, O. (2002), Promoters and parasites. An alternative explanation of price dispersion in the art market, *in* G. Mossetto and M. Vecco, eds, 'Economics of Art Auctions', Milano: FrancoAngeli, pp. 130–150.

Velthuis, O. (2003), 'Symbolic meanings of prices: Constructing the value of contemporary art in Amsterdam and New York galleries', *Theory and Society* **32**(2), 181–215.

Velthuis, O. (2007), *Talking Prices: Symbolic Meanings of Prices on the Market for Contemporary Art*, Princeton, MA: Princeton University Press.

Velthuis, O. (2011), Damien's dangeour idea: Valuing contemporary art at auction, *in* J. Beckert and P. Aspers, eds, 'The Worth of Goods: Valuation and Pricing in the Economy', New York, NY: Oxford University Press, pp. 178–200.

Velthuis, O. (2012), The contemporary art market between stasis and flux, *in* M. Lind and O. Velthuis, eds, 'Contemporary Art and its Commercial Markets', Berlin: Sternberg Press, pp. 17–50.

Velthuis, O. and Baia Curioni, S., eds (2015), *Cosmopolitan Canvases: The Globalization of Markets for Contemporary Art*, Oxford: Oxford University Press.

Velthuis, O. and Coslor, E. (2012), The financialization of art, *in* K. Knorr-Cetina and A. Preda, eds, 'The Oxford Handbook of the Sociology of Finance', Oxford: Oxford University Press, pp. 471–487.

Vosilov, R. (2015*a*), Art auction prices: Home bias, familiarity and patriotism, Mimeo, Available at SSRN: `www.ssrn.com/abstract=2686527`.

Vosilov, R. (2015*b*), Uncertainty, disagreement and expert price estimates in art markets, Mimeo, Available at SSRN: `www.ssrn.com/abstract=2686522`.

Wang, R. (1993), 'Auctions versus posted-price selling', *The American Economic Review* **83**(4), 838–851.

Wang, R. (1995), 'Bargaining versus posted-price selling', *European Economic Review* **39**(9), 1747–1764.

Wijnberg, N. M. (1995), 'Selection processes and appropriability in art, science and technology', *Journal of Cultural Economics* **19**(3), 221–235.

Wijnberg, N. M. and Gemser, G. (2000), 'Adding value to innovation: Impressionism and the transformation of the selection system in visual arts', *Organization Science* **11**(3), 323–329.

Wolff, J. (1981), *The Social Production of Art*, London: MacMillan Press.

World Bank (2016), World Development Indicators database - GDP, Retrieved at: http://databank.worldbank.org/data/download/GDP.pdf, October 10, 2016.

Wu, S. D. (2004), Supply chain intermediation: A bargaining theoretic framework, *in* D. Simchi-Levi, S. D. Wu and Z. M. Shen, eds, 'Handbook of Quantitative Supply Chain Analysis: Modeling in the E-Business Era', Boston, MA: Kluwer Academic Publishers, pp. 67–115.

Zorloni, A. (2005), 'Structure of the contemporary art market and the profile of Italian artists', *International Journal of Arts Management* **8**(1), 61–71.

Zorloni, A. (2013), *The Economics of Contemporary Art*, Berlin: Springer.