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Abstract

We study the XVII century market for figurative paintings in Italy, analyzing original contracts between patrons and artists: this is one of the first manufacturing markets for which econometric evidence of the basic laws of economics can be found. Size of paintings, expected quality, type of commissions and aggregate shocks affect prices as expected. We find evidence of contractual solutions to moral hazard problems in the patron-artist relation: since quality was not negotiable, prices were made conditional on correlated variables such as the number of figures depicted. We find evidence of price equalization between high and low demand destinations due to endogenous mobility of the painters (or the paintings). We also provide support for the Galenson hypothesis of a positive relation between age of experimental artists and quality as priced by the market.

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1. Introduction

A wide economic history literature has analyzed pre-industrial markets to find evidence of the basic laws of economics. Given the limited amount of data available, most studies have focused on the aggregate fluctuations of prices and quantities in agriculture and on international trade of commodities. For instance, McCloskey and Nash (1984) and Clark (1988) rationalized the adoption of the inefficient system of open fields in English pre-industrial agriculture as an insurance device against frequent shocks[1] and the late investments in enclosure of the open fields as a natural consequence of the late reduction of the cost of capital. O'Rourke and Williamson (1999) investigated price convergence in Atlantic trade as a sign of market integration and increased competition, but only recently Rönnback (2009) has found evidence of such price convergence for sugar, tobacco, tea, pepper and other commodities between the XVI and the XVIII century. More difficult is to find direct evidence on equilibrium prices and contracts in the pre-industrial manufacturing sector because information on sellers, buyers and the goods hardly survived. A remarkable exception is the market for paintings: here we still have wide information about the sellers (the artists), that have been the subject of research and analysis in art history, about the buyers (the patrons), whose documentary evidence, including contracts and payments' notes, often survived until today, and about the goods (the paintings), that oftentimes are still visible in their original locations or in public or private collections.

We analyze empirically the Baroque market for figurative paintings in Italy to find evidence of the laws of demand and supply and of the rational behavior of agents in their contractual relations. Evidence in such a market is important because this is an extreme example of a market in which we may expect that rationality plays a minor role: art objects are often perceived, and sometimes defined, as handmade works that are valuable independently of their objective features and as the fruit of pure talent and inspiration independently from monetary and contractual incentives. At the same time, the pricing of a unique art object is often perceived as highly subjective and largely dependent on the tastes, wealth and prestige of buyers, with little regard for factors affecting demand and supply, especially when one is thinking of the XVII century, in which honor and prestige were claimed to be the drivers of social and economic activities more than the profit-seeking behavior of the *homo economicus*. Our purpose is to show that these perceptions are largely misleading.

The empirical analysis is built around a new unique dataset on original contracts between commissioners and painters based on the recent monumental art historical research by Spear and Sohm (2010). We focus on commissions for large oil paintings of figurative (religious or mythological) subject, produced in the main Italian art centres (Venice, Rome, Florence, Bologna and Naples) in the XVII century, and we investigate the relation between the price of paintings and a number of variables characterizing the same paintings, the painters, the commissioners and the macroeconomic context.

The equilibrium prices can be interpreted in terms of hedonic prices reflecting the expected aesthetic value of the paintings, which we capture by artists' fixed effects. Beyond this, we show that a number of supply and demand factors affect the equilibrium prices: for instance, we find a positive and concave relation between prices and size of paintings reflecting economies of scale in the production of paintings. More interestingly, we find evidence of contractual solutions to moral hazard problems between patrons (principals) and artists (agents). Large commissions for oil paintings of historical subject required months or years of work and generated conflicts of interest for the simple reason that quality required time and effort, but was not negotiable *ex ante* or measurable *ex post* (Nelson and Zeckhauser, 2008).

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[1] See McCloskey (1972) and Fenoaltea (1976) on this debate.

Federico Barocci: Madonna del Popolo (1579), Uffizi, Florence

We provide evidence that patrons and artists adopted a typical solution to the moral hazard problem pointed out in the literature on principal-agent contracts (Holmstrom, 1979). Prices were made conditional on measurable features of the paintings which were positively correlated with effort and quality, the main one being the number of human figures depicted in the composition (after controlling for size and painters' features).

Moving from microeconomic aspects to macroeconomic ones, we evaluate the impact of local and aggregate demand shocks. Differences in local demand could be detected when looking at different destinations. Demand was higher in larger and richer cities such as Rome compared to smaller provincial towns in the countryside, but the mobility of painters was high, therefore we expect that price differentials between high-demand and low-demand towns was arbitraged away. Indeed, we find that prices in the countryside were lower but, after controlling for paintings' and painters' features, this price differential disappears. This suggests that the structure of the market, summarized by the number of active painters (or traded paintings) at the local level and the equilibrium prices, was endogenous and the opportunities for extra profits were eliminated through the mobility of the painters (or the paintings).[2] While market forces appear to have been at work to induce price equalization within largely integrated markets as those of the Venetian Republic and of Central Italy, aggregate demand shocks exerted direct effects on prices, as was the case for the plague.

Finally, we provide novel support for the Galenson hypothesis (see Galenson and Weinberg, 2000, and Galenson, 2006) concerning the life cycle of the painters: experimental innovators (exemplified by Titian, Tintoretto, Domenichino or Guido Reni) increase gradually the quality of their work (as priced by the market) while aging and improving their techniques by experience, while conceptual innovators (exemplified by Caravaggio) do not exhibit a positive correlation between quality and age.

As far as we know, this is the first work to test theoretical predictions for the art market on data from original contracts between artists and patrons. But our analysis is related to two strands of literature. The first analyzes the impact of economic factors on the art market. There is a long tradition in art critique regarding the relation between social and artistic developments (see Hauser, 1951), but only recently economists as De Marchi (1995) and Monthias (2002) and economic historians as North (1999) have emphasized the importance of economic incentives in shaping the Dutch art market of the XVII century. O'Malley (2005) and Nelson and Zeckhauser (2008) have provided the first studies of the art contracts during Italian Renaissance. Spear and Sohm (2010) have extended the analysis to the subsequent Baroque period, deriving an interesting analysis of the economic lives and incomes of the painters. But the key contribution of these works is data collection because, although they provide a fine descriptive analysis, they do not carry out econometric investigations or test economic hypotheses.[3] The second relevant literature was started with the works by Galenson (2006) on the relation between age and artistic innovations. Most of the econometric evidence in support of the Galenson hypothesis relative to the different age profiles of quality production for experimental and conceptual innovators is based on data from modern auctions for modern art (Galenson and Weinberg, 2000; Hellmanzik, 2010). Our study allows us to evaluate the Galenson hypothesis for old master painters looking at the relation between their age and the aesthetic value of their work as perceived and priced at their time.

In the next section the reader will find a description of the market and of a number of theoretical implications for its . The following part presents and analyses the data on paintings produced in the Venetian Republic, which could be regarded as a fully integrated market. Finally

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[2] See Etro (2009) for a survey of the endogenous market structure approach in general equilibrium.

[3] The only related multivariate analysis we are aware of is by Gérin-Jean (2003), who investigated the determinants of the prices of heterogeneous artworks, including statues, decorative objects and also paintings of any subject, from inventories (and not original contracts) of the Medici period, mainly with predictive and ranking purposes. However, the procedure used for converting prices into a unique currency and the adjustment for inflation (using an index computed for England) appear inaccurate.

we extend the empirical analysis to the other art centres of Central Italy and discuss the life-cycle of artists.

2. The Market for Oil Paintings

During Renaissance a large part of the accumulated wealth of the Italian urban centers was channeled toward demand for durable goods with artistic content, from architecture (palaces, villas, churches,..) to sculpture and any decorative element of the liturgical apparatus including, of course, altarpieces and other paintings (Goldthwaite, 1993). The peak of this process was reached in the Baroque period, with its churches and chapels filled with the richest and most extravagant decorations and paintings on the altars and on the entire space of walls and even ceilings. Such early form of "consumerism" spread to public and private buildings developing a wide market for luxury goods, in which paintings of different kinds were playing a prominent role.

By the XVII century, the Italian market for paintings was characterized by a wide product differentiation: while most paintings from the previous centuries were figurative (mainly of religious or mythological subject), the raising demand from private buyers induced the production of new subjects (as landscapes, genre paintings and still lifes beside portraits and battles,...). Only the best painters were engaged in traditional figurative paintings, especially altarpieces,[4] whose more ambitious compositions could include many interacting figures depending on the ability of the painter at representing a particular subject (or plot).

The market for oil paintings of figurative subject could be seen as characterized by competition in prices between differentiated producers and by endogenous entry of these producers. In the main art centres, as Rome, Florence and Venice, local artists were organized in guilds or academies and had to pay an entry fee to access the guild. It allowed them to create their own workshop and employ assistants (the amount of capital and labor employed was rather similar across workshops) and trade their paintings under common rules. But notice that these guilds were not very effective at protecting the rents of their members.[6] First, some low quality or foreign painters were able to avoid enrollment and practice the art without following the basic rules decided by the guild. Second, competition was strong and sometimes even predatory, with painters undercutting each other, adopting different forms of price discrimination, and heavily advertising their works.[7]

Effective mobility was extremely high in this market, especially within the Venetian Republic and between the towns of Central Italy, as Rome and Bologna, which belonged to the Papal States and also Florence and Naples, which maintained close economic, political and artistic links with Rome in this period. Italian and foreign artists could easily travel between close art centres,[8] and painters could even receive commissions from distant locations, paint in their own workshop, and send the finished products to the final destination (especially since the canvas replaced the wood panel as support). Transport costs were low, though small import tariffs existed between different states, as between the Venetian Republic and the Papal States. On the other side,

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[4] Painted altarpieces had a long standing tradition in Italy. Between the XIII and XVI century different kinds of altarpieces coexisted, with at one extreme polyptychs on wood panels with multiple surfaces painted with expensive colors (gold and ultramarine blue, usually paid by the patrons) and surrounded by expensive carved and gilded frames, and at the other extreme simple rectangular canvases prepared without golden backgrounds and frames. By the mid XVI century and for the following two centuries, the latter typology of altarpieces, and its minor variations for wall and ceiling decorations, became a rather common product whose market is the subject of our study.

[6] For discussions about the limited role of the guilds of the pre-industrial age in protecting monopolistic rents see Ogilvie (2004) and Richardson (2007).

[7] Luca Giordano said he could paint with three brushes for different prices: a gold brush, a silver one and a bronze one (for the latter he was called Luca fa' presto, literally "Luca does it quickly").

[8] There is wide and clear evidence for this. Venice had a long tradition for receiving North European artists (at least since the arrival of Durer), and Rome started attracting foreign painters since early Renaissance. During the XVII century Venice imported many foreign artists (as Heintz, Loth, Strozzi) and also temporarily exported others (as Ricci or Pellegrini), while Rome was the leading international centre for artists from all Europe.

commissioners were open to deal with painters from any provenance as long as they satisfied their tastes: the traditional difference between the Venetian style (emphasizing *colore*) and the Central Italian style (emphasizing *disegno*), pointed out by Vasari, allows us to conjecture the existence of at least two main areas of common stylistic preferences, one in the Venetian Republic and one in Central Italy. On the basis of these considerations about mobility of supply and demand preferences, a conservative conclusion is that the northern market within the Venetian Republic could be certainly regarded as a highly integrated market and the Central Italian market including Rome, Bologna, Florence and Naples could be seen as another equally integrated. For this reason they will be analyzed separately below.

Large oil paintings required months of work and sometimes even years, though artists were used to work contemporaneously on multiple commissions and on other minor paintings with the help of assistants under their direct control and responsibility. Most commissions for figurative paintings were formalized in detailed contracts signed in front of notaries with validity throughout Italy, and defining the price and the mutual responsibilities of the principal (the patron) and the agent (the artist). Of course, these principal-agent contracts were largely incomplete, because the main issue, the quality of the paintings, could be observed by the principal, but it could not be defined *ex ante* or verified *ex post* (see also Nelson and Zeckhauser, 2008). Painters did care about their reputation, which led them to exert a certain effort. But a reputational constraint alone could not provide the right incentives to guarantee the quality levels that different patrons were looking for.

The supply of paintings was depending on the number of painters of different quality available and on their productivity, affected by type and quality of their production.[10] The demand of paintings derived mainly from churches, public buildings, and private collectors. Bigger and richer cities, where more churches were built, more prestigious buildings existed and wealthier patrons lived, were clearly demanding more and higher quality paintings.

2.1 Basic determinants of art prices

What are the main determinants of the (hedonic) price of paintings? Some of them are relatively straightforward and are used as control variables. Let us start from the supply side. First, we expect prices to increase with the size of paintings, a proxy for the production costs, but in a less than proportional way because of likely economies of scale: a painting of any size required some time for thinking about the composition and for working on preparatory sketches. Another obvious determinant of the price of a painting is the expected quality supplied by each painter, which translates in the aesthetic value as perceived by the contemporary audience: it can be directly controlled with artists' fixed effects (we also tried a quality index based on the income of painters with similar results).

Other crucial elements of a commission for a painting were related to the demand side. A crucial factor was the type of the commissioners: differences in their willingness to pay may have affected the contracts in place and through them the prices.[11] Another factor is the final position of the painting: the hierarchy of spaces within churches and buildings and the substitutability with competing decorations could affect the elasticity of demand and therefore the prices. Finally, multiple commissions may have commanded lower unitary prices as a form of quantity discounts.

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[10] Productivity was clearly affected by the organization of the workshop and by the number of apprentices: this had an impact on the number of paintings produced by each workshop, but it could not have a relevant impact on the average quality and cost of each painting.

[11] A sort of efficiency wage mechanism may have taken place for some commissions. Some public patrons or the Pope for St Peter's were available to pay more than others to induce extra-effort for their occasional commissions, and the artists employed by them were available to exert this extra-effort to obtain additional commissions and avoid going back to the ordinary market - where these efficiency wage mechanisms were absent.

2.2 Number of figures: a solution to a moral hazard problem

There are not deep artistic reasons for which the counting of the human figures in a painting should affect prices.[13] Spear and Sohm (2010) do not find wide documentary evidence of an explicit impact of the number of figures on prices of altarpieces. But prices may have been decided on the basis of the number of figures even without stating a price per figure in the contracts. Further agreements on the number of figures may have been established in separate notes, letters or even verbal communications.[14] Most important, we know that pricing by number of figures became a typical procedure during the early '600s in the city of Bologna, where the leading painters Guercino and Guido Reni were able to maintain their high fees justifying them with a commitment to a high price per figure (again, rarely written in contracts but implicitly recognized in many agreements).[15]

From an economic point of view, there could be an efficient rationale for the adoption of prices increasing in the number of figures. This emerges if we look at the patron-artist contracts from the perspective of principal-agent contracts chosen to maximize the payoff of the patrons taking into account the incentives of the artists in exerting effort.[16] The patrons' payoff could be seen as the difference between the benefits obtained with the commissions and the price paid to the artists. The benefits of the patrons were in terms of display of what they called "magnificence" in front of the contemporary audience, of the high class elite and, in case of altarpieces, even in front of God(see Nelson and Zeckhauser, 2008). Clearly, the signaling benefits from these ostentatious commissions were positively related to the quality of the artworks. Since the latter was not directly negotiable (and verifiable), moral hazard was a relevant issue (because quality required also costly effort) and the optimal patron-artist contracts had to be based explicitly or implicitly on any verifiable and measurable feature of the painting that was correlated with effort and quality (according to the informativeness principle first stated by Holmstrom, 1979).

In the case of figurative paintings, this was possible through the number of human figures, which was not equivalent to the absolute quality of a painting, but was correlated with it for at least three main reasons. First of all, the subjects of the commissioned paintings were biblical or mythological stories of man, women, saints, angels or mythological gods, where imagination and story-telling had a crucial function. Therefore, one could safely conclude that the variety and complexity of the composition, summarized by the number of players, had a positive, though partial, correlation with effort and final quality. Second, at the time there was a precise ranking in the aesthetic evaluation of subjects, with figurative compositions at the top and landscapes, genre paintings and still lifes in decreasing order of appreciation. A higher number of human figures was reducing on average the space available for subjects of lower perceived quality, as background landscapes or decorative still lifes, and this was automatically enhancing overall quality. Third,

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[13] In letter of 1667, the painter Cortona criticized a positive relation between number of figures and price: "*Others say that the space between one figure and another are a weakness, [which] shows a lack of understanding of painting because sometimes those spaces are necessary for artistic reasons, as the petitioner has done, and not to save labor.*"

[14] For instance, this happened in one of the rare epistolary negotiations survived until our days and involving the Venetians painters Liberi and Zanchi (see Spear and Sohm, 2010, pp. 13-15).

[15] Apparently, Guercino was an extreme example, because he claimed to commit to a fixed price of 100 scudi per full-lenght figure (50 for half-lenght figure, 25 for heads); however, this could be part of a sophisticated bargaining technique because deviations from this "commitment" were the rule rather than the exception. In a letter of 1628, Guido Reni argued that the low level painters could not obtain more than 2 or 3 scudi for large life-size figures and ordinary painters could ask at most 15 scudi per figure, while an extraordinary painter like himself could name his own price on the basis of the quality of his work independently from size and number of figures. This was probably another selling technique, but it may have reflected a way of thinking about the relation between prices and the number of figures.

[16] To induce effort many other contractual solutions were adopted. First of all, many contracts required preliminary drawings to be evaluated and possibly approved by the commissioners. Second, *ex post* rejection of the painting in case of low quality was a credible threat for the artists. However, both these practices could only insure a minimum level of effort. Third, contracts occasionally left space for bonuses for quality between 10 % and 20 % (O'Malley, 2005, p. 125): judgement was sometimes by the commissioners and other times by external painters, inducing conflicts of interests in both cases. The last practice may be seen as a sort of incentive contract, but its effectiveness appears limited.

painters were often focusing their own effort on human figures and especially on difficult parts as the heads (where their own style was more easily recognized), delegating less relevant parts (including background decorations, landscapes and still lifes) to their own assistants. Accordingly, a higher number of figures was a proxy for a wider direct intervention of the painters in the overall execution, and consequently for higher quality. In conclusion, if such contractual motivation was relevant, *ceteris paribus*, one may expect a positive relation between prices and the number of figures.[18]

2.3 Demand factors and endogenous market structures

A standard common wisdom in art history is that prices were higher in large cities (where demand was higher) than in smaller towns. In 1625, Fra Atanasio, an art dealer who was negotiating an altarpiece by Cerano in Milan, told the patron that the painter would have probably accepted 250 scudi, but also that if Cerano were to go to Rome he would be paid 500 scudi, claiming the existence of a high price differential between a large art centre as Rome and a smaller (but not even peripherical) one as Milan (Spear and Sohm, 2010, p. 233). Similar understanding was quite spread at the time: large cities were perceived as paying better their commissions and Rome better than all the other cities. According to Spear and Sohm (2010, pp. 234-235) anecdotal evidence on the higher prices in richer cities is also confirmed by the data on average prices for Venice and minor Venetian towns between the second half of '500s and the beginning of '700s.

From an economic point of view, the high mobility of painters suggests that important adjustment mechanisms could have been at work when price differentials emerged between cities. Suppose that wealthy Roman commissioners were systematically paying more than commissioners from the countryside for similar paintings. In such a case, painters from the countryside should start supplying their paintings only to Rome, migrating there or simply sending their works there, which would tend to reduce the average prices in Rome and increase the average prices in the countryside. On the other side, suppose that Roman painters could systematically earn more by exporting their altarpieces to foreign cities: then they would all try to conquer foreign commissions generating an upward adjustment of the local prices. As a consequence, prices of similar paintings in different locations should converge.

The process of price convergence for comparable paintings should be quite rapid in the Venetian Republic because the mobility of painters and paintings could be regarded as almost perfect between Venice and its neighboring towns as Verona, Vicenza, Padua, Treviso or Bergamo (there were no tariffs and transport costs were low). The same could be said around Rome, especially within the Papal States, including Bologna, and in the close artistic centers of Central Italy, which maintained strong political and economic links with Rome throughout all the century. In conclusion, the endogeneity of the market structure associated with a high mobility of painters implies that one may expect the lack of any significant correlation between prices and destinations, after controlling for all paintings' and painters' features.

Finally, while local or temporary differences in demand may create adjustments through the mobility of painters, aggregate shocks could not. In the absence of reliable data on the business cycles, we can only look at famous historical shocks as the plagues. During the XVII century two main plagues had a dramatic effect in our two regions: the one of 1630-1631 in Northern Italy and the one of 1656 in Central Italy. The major impact of these shocks was definitely on the demand side. The economy was heavily hit, and spending money on art was hardly the priority in the years after the plague: accordingly, such a negative demand shock should have induced a generalized reduction in demand and prices.

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[18] As noticed by Deirdre McCloskey in personal communications, from the information on the number of figures in figurative paintings and on the statistical relation between them (possibly a concave relation) one may infer how much it did cost to add human figures. Such an idea definitely deserves further investigation.

Domenichino: Diana and Her Nymphs (1616-17), Galleria Borghese, Rome

2.4 The age of painters and the life-cycle of artistic creativity

The commissions for paintings of figurative subject under our investigation represented the most important segment of the market for paintings and were assigned only to artists whose reputation and value was already well established. This implies that any basic learning process or reputational growth for these painters was taking place mainly before the entry in the market for these important commissions (or was actually a pre-condition for it). In spite of this, age could still affect the quality of paintings, as priced by the market, for an ideal category of artists that a celebrated book by Galenson (2006) has defined as experimental innovators. They are painters able to develop a gradual and continuous path of experimentation and change during their career. According to the Galenson hypothesis, experimental innovators keep improving with age the quality of their work as appreciated by experts and priced by the market, or, at least, their life-cycle profile for earnings reaches a peak at a very advanced age. According to Galenson and Jensen (2001), leading examples of experimental innovators[19] have been Michelangelo, Titian and Rembrandt, but other examples of these step-by-step innovators may have been Tintoretto, Reni, Domenichino and Ricci.

The separate category of conceptual innovators does not need much time to develop innovations because these are pathbreaking (and often not understood and poorly priced) changes derived from a radically different perspective on the same artistic problems. The Galenson hypothesis is that conceptual innovators tend to reach their maximum quality at a young age, and therefore they should not exhibit a significant relation between age and quality as priced by the

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[19] Notice that innovations are not absolute improvements per se: they are simply changes that are appreciated by the contemporary audience and that, if markets are properly working, are also better paid.

market (or, at least, they should reach a peak at a very young age). Galenson and Jensen (2001) propose the examples of Masaccio in the XV century and Raphael in the XVI century, but the most prominent example may actually be Caravaggio in the XVII century.

Galenson and Jensen (2001) and Galenson (2006) test empirically this hypothesis on the basis of modern auction prices for modern painters, but give up such a challenging enterprise for the old masters given the lack of data on prices from the XV-XVII centuries. Our dataset on the Baroque period provides a basis for a systematic analysis of the life-cycle of artistic creativity and of the Galenson hypothesis on old Italian masters. First of all, the coexistence of experimental innovators (with a positive relation between age and innovative quality, at least up to a certain age) with conceptual innovators and non-innovators (without such a positive relation) should preserve on average a positive and possibly concave correlation between age and innovative quality. Therefore, assuming that prices were reflecting quality, we may expect, *ceteris paribus*, a positive or an inverse-U relation between age and prices. Beyond such a weak test of the Galenson hypothesis, one could examine single cases of different kinds of innovators for a stronger support of the same hypothesis.[20]

3. The Market in the Venetian Republic

Let us focus on the market for paintings produced in the Venetian Republic, which, as mentioned above, could be considered as an integrated market for economic, political and even artistic reasons. Moreover, our dataset on this market contains detailed information that is not available for the rest of Italy. The main source of the data is the monumental work of Spear and Sohm (2010), who have collected information from original contracts and other documentary evidence on prices (all converted in silver ducats) and on other characteristics of 254 oil paintings made between 1551 and 1746 by 61 artists of any provenance active in the Venetian Republic. We can fairly look at the sample as representative of the (many more) commissions for oil paintings of high quality that took place at the time. The survival of documentary evidence on these contracts for about four centuries is largely random. Fires, wars and other accidental events have spread losses of documents across all the original archives. Art historians have looked at the surviving archives for decades, finding contracts for more or less important paintings in a random way. Nevertheless, one should keep in mind that the dataset does select paintings by artists whose reputation was good enough to get commissions from important patrons; in other words, the fringe of minor (and today mostly anonymous) painters engaged in minor commissions and genres is absent. Given this, we believe that the dataset can be regarded as broadly representative of the market for high quality commissions for figurative paintings.

Table 1

Summary statistics – Venetian Republic

Variables	Mean	Std. Dev.	Min	Max
Price	193.50	245.83	5	2306
Size	12.42	14.15	0.4	84.8
Number of figures	9.77	9.40	1	59
Age	52.22	13.61	22	81

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[20] Art history research on old master paintings has not advanced a systematic investigation of the relation between age and artistic innovations, and even less between age and monetary compensation in the market. Only some anecdotal evidence is available and by no means conclusive (for instance Spear and Sohm 2010, p. 28). In the absence of other implications from art historical studies, we will mainly focus our attention on the weak version of the Galenson hypothesis: a positive or an inverse-U relation between prices and age.

Table 2: *Log of Price – Venetian Republic*

Independent variables	(1)			(2)			(3)		
PAINTINGS' CHARACTERISTICS									
Size	0.034	***	(0.004)	0.099	***	(0.009)	0.090	***	(0.009)
Squared size				-0.001	***	(0.000)	-0.001	***	(0.000)
Nr figures				0.033	***	(0.007)	0.028	***	(0.006)
Wall * Church				-0.868	***	(0.117)	-0.691	***	(0.113)
Ceiling * Church				-0.227		(0.219)	-0.109		(0.217)
Secular commissioner				-0.169		(0.120)	-0.092		(0.125)
Minor destination	-0.294	*	(0.162)	-0.270	**	(0.125)	-0.176		(0.132)
Verona/Vicenza	-0.337	*	(0.184)	-0.397	***	(0.141)	-0.182		(0.144)
Bergamo	0.277		(0.286)	0.049		(0.212)	0.101		(0.237)
Padua	0.441		(0.308)	0.224		(0.222)	0.096		(0.214)
Treviso	0.237		(0.356)	-0.026		(0.260)	-0.027		(0.253)
Exports	0.572	***	(0.219)	0.236		(0.158)	0.146		(0.159)
Multiple commission				0.062		(0.103)	0.014		(0.112)
PAINTER'S CHARACTERISTICS									
Age							0.034	**	(0.015)
Squared age							-0.000		(0.000)
Balestra							1.770	***	(0.359)
Bassano J.							0.482		(0.301)
Bassano F.							0.204		(0.402)
Cavagna							0.307		(0.401)
Celesti							0.663	**	(0.298)
Fumiani							0.799	**	(0.388)
Lazzarini							1.108	***	(0.401)
Liberi							1.642	***	(0.303)
Maffei							0.639	**	(0.323)
Padovanino							1.013	**	(0.446)
Palma the Younger							1.111	***	(0.201)
Pittoni							1.697	***	(0.371)
Ricchi							0.878	**	(0.370)
Ricci							1.594	***	(0.292)
Ruschi							1.828	***	(0.403)
Tiepolo							1.281	***	(0.368)
Tintoretto							0.540	***	(0.202)
Titian							1.196	***	(0.378)
Veronese							0.898	***	(0.250)
Zanchi							1.432	***	(0.254)
Others							1.094	***	(0.202)
OTHER									
Date				0.006	***	(0.001)	0.001		(0.001)
Plague				-0.504		(0.313)	-0.592	*	(0.321)
Constant	-0.814	***	(0.116)	-11.228	***	(1.191)	-5.005	**	(2.306)
Observations	254			254			254		
R-squared	0.251			0.649			0.761		

Notes. Standard errors in parentheses. Reference categories: Altarpiece, Destination=Venice, Secular commissioner, Painter=Farinati

*** p<0.01, ** p<0.05, * p<0.1

Using other information from art history sources, we obtained the following data for each painting: title, author and size of the painting, number of figures included in the composition (counting partially the half-length figures and the heads), position of the painting in the building (i.e. on a main or secondary altar, on the ceiling, or on lateral walls including the organ), commissioner's type (church, public authority or private collector), date of commission and age of the artist when the painting was made. We also built variables indicating whether the painting belonged to a commission of multiple works, the town of destination and the perceived quality of the painters (proxied by the artists' fixed-effects).

Table 1 shows a partial list of the variables we used in the empirical analysis together with their main summary statistics. The average painting had a price of 193.5 Venetian silver ducats, was more than 12 square meters large and contained almost 10 figures. Nevertheless, the variability of these factors was wide. The religious commissioners were 75 % and 41 % of the commissions were for altarpieces. The rest of the paintings were destined to the decoration of walls (48 %) or ceilings (11 %) of churches or buildings. Only 41% of the artworks in our sample were for Venice. Among the other more common destinations in the Venetian Republic we find Verona and Vicenza (15 %), Bergamo (5 %), Padua (4 %) and Treviso (3 %). Almost one fifth of the paintings were addressed to some Minor destination, that is small provincial towns within the countryside of the Venetian Republic (for instance Castelfranco Veneto, Trevenzolo, Lentiai, Salò,..). About 10% of the paintings in our dataset were exported, mostly to other Northern Italian towns as Turin, Milan and Genoa or outside Italy. Trade with Central Italy was limited and the stylistic differences of the Venetian scholl from the rest of Italy may have played a role for this. The average age at which artworks were made in Venice was above fifty, rather high for the living standards of that time. This may reflect the importance of the commissions to which the observations in our dataset refer: most painters started their careers as assistants to their masters, preparing minor works or even copying others' paintings, and only after a few years they started receiving commissions from churches and other important patrons. Of course, the late average age may also reflect the relatively good living conditions of the painters.

A time trend is used to control for macroeconomic trends (we also tried with dummies for decades without substantial differences). We have also examined historical macroeconomic events that may have affected the market for paintings, and the only one with a relevant impact was the plague of 1630-1631. As mentioned above, we expect a reduction in the number of traded artworks in the period following this episode, and possibly a price reduction. Indeed, although our data do not represent the universe of the works of art produced and traded on the market, the paintings produced in the two decades immediately following the plague represent just 4.7% of our sample, less than the average percentage for a single decade. This same fact provides indirect evidence regarding the contraction of the art market in the period immediately following the plague. Further evidence may emerge from the impact on prices.

3.1. Empirical analysis

Following the spirit of the hedonic price literature, we regress the natural logarithm of the real sale price of these paintings on a set of paintings' and artists' characteristics.

The prices of paintings in the dataset are expressed in Venetian silver ducats. During the entire XVII century, the price level was rather stable all over Italy, but the second half of the XVI century was characterized by a sustained inflation (due to the central European silver mining boom and to the import of American silver), and the first half of the XVIII century exhibited wide price variability. Therefore, we have to take into account changes in the price level over the two centuries under consideration. To this aim, we convert nominal prices in real terms by first converting ducats in the units of account, the liras - according to the constant exchange rate of 1 ducat per 6 liras and 4 soldi, where a lira contains 20 soldi (see Martini, 1883), and, secondly, by using information regarding the quantity of Venetian liras necessary to buy a hundred kilograms of wheat, as

calculated by Malanima (2002).[23] Using this procedure we translate nominal prices in real terms reflecting the cost of living and its changes during the period under analysis and, thus, we base our econometric investigation on a more reliable measure of artworks values, that is on ducats' purchasing power.

The control variables include paintings' characteristics, first of all the size and the number of figures. Squared size is also considered in order to test for economies of scale. Moreover, we include a set of indicator variables for the paintings' position, for the type of commissioner and for the final destination, with Venice as the excluded category. Another control is the age of artists at the time the paintings were produced; squared age is also entered to check for concavity in the age-price profile. In order to take into account of changes in the Venetian art market in the period under analysis, we insert among regressors the year in which the painting was executed (whose coefficient represents the time trend). We finally control for the plague effect by means of a dummy variable for the decade immediately following this episode (1631-1640).

Table 2 shows OLS estimates of the price equation. The three columns in the Table present results from three different specifications obtained following a stepwise procedure. In column 1 coefficients result from estimation of the most parsimonious price equation containing only the dummies for destination and size of paintings; in column 2 we control for the attributes of the artworks while in column 3 also painters' characteristics are controlled for. The first remarkable thing to notice is that the R^2 in the full specification of column 3 is equal to 76.1%, pointing out a good overall fit and providing first evidence of the existence of a systematic pattern in the process of price determination. Moreover, generally the parameters take the expected sign and by and large they support our main hypotheses on the process of oil paintings' price determination.

Focusing on the full specification, we find a premium of around 9% per square meters and this confirms that larger paintings were paid more. Additionally, we find evidence of weak scale economies in the production technology, as suggested by the negative and significant coefficient of squared size. The number of figures plays a role in price formation. More specifically, each figure brings an increase in painting's price of around 3%. As pointed out before, there can be a contractual rationale behind this result. Large oil paintings of historical subject were complex works often taking months or years to be completed and raised serious moral hazard issues on the effort exerted by painters in producing quality. Given the impossibility of specifying quality (or the "aesthetic worth") in contracts, the optimal patron-artist contract had to rely on measurable features that were correlated with perceived quality, a standard principle (known as informativeness principle) in principal-agent contract theory (Holmstrom, 1979). As argued before, the number of human figures was such a measurable feature and appears to have been extensively used in price determination.

Another factor correlated to paintings' price was the position where they were planned to be placed. Artworks produced for wall decorations in churches were paid much less than altarpieces. Because of the presence of a larger number of substitutes for decoration of lateral walls, especially in churches, the demand elasticity was higher for wall paintings than for both altarpieces and ceiling. This higher elasticity is likely to be the reason for this price differential. On the other hand, we do not find any relevant difference between prices of altarpieces and ceilings, whose demand was more rigid (because of the lack of substitute decorations and the limited space available for these artworks).[24] Finally, there is no robust evidence of quantity discounts for multiple commissions.

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[23] Better inflation indexes are not available, but wheat was an essential good for most of the population and its price variations were likely to be reflected in those of many other goods. A similar methodology is used by Cecchini (2000) to estimate the demand of paintings in Venice during the XVII century from inventories of Venetian families. Price series for other destinations could be used as well, but at the risk of increasing the problems of comparability with minor improvements in accuracy. Moreover, a precondition for price equalization in our market would necessarily be price equalization in a market for homogenous goods as wheat.

[24] The subjects of paintings did not affect prices and therefore we excluded the corresponding variables from the set of regressors.

Prices do not exhibit a temporal trend with the exception of the price reduction during the decade following the plague (however, a more accurate control for all the decades shows a tendency toward a price increase associated with the renaissance of Venetian art in the first half of the XVIII century). A very interesting and remarkable estimation result is that, *ceteris paribus*, the final destination of the painting did not matter for its price determination. Given the importance of this result, we will revisit this topic in greater depth in the following subsection.

Let us move to the variables related to the painters. First of all, let us look at the artist fixed-effects, introduced for all painters with at least 3 observations. The omitted painter is Farinati, which appeared to be the least paid painter in the dataset. The coefficients for the artists show that the most famous painters as Ricci, Tiepolo, Titian, Palma the Younger and Veronese or well established painters at the time as Ruschi, Balestra, Liberi and Zanchi commanded top prices. An exception is Tintoretto, but this should not be entirely surprising. During most of his life, Tintoretto had to compete with great masters as Titian and Veronese, and was known for his repeated predatory techniques: he often accepted low prices in exchange for sure commissions. Moreover, he was particularly rapid in producing paintings: his sketchy style allowed him to complete numerous altarpieces, huge canvases for private and public buildings (including the largest canvas in the world, the Paradise of the Ducal Palace) and an impressive amount of portraits in a relatively short time, which made him available to accept lower prices than his rivals.

Finally, let us consider our last crucial explanatory variable, the age of execution of paintings. Our results are consistent with the hypothesis that some artists in our dataset were "experimental innovators", that is painters who, thank to a gradual development of their artistic ability, were able to improve their quality, as perceived and priced by the market, with the progress of their career. As a matter of fact, the coefficient for age of painter denotes an average increase in the price of paintings by around 3% a year. In Section 4 we will present some additional evidence on the role of age in the case of some specific significant painters present in the dataset in order to see how the Galenson (2006) hypothesis relative to the age-quality profile was at work during the Baroque era.

3.2 Destination effects: endogenous market forces at work

We just found that, once controlling for painting's and painter's characteristics, there is no price differential between artworks addressed to different geographical locations. Although anecdotal evidence suggests that in large and prestigious art centers prices of art were higher than in small provincial towns, our results seem to challenge this belief. However, despite this result goes opposite to the standard perception, it is in line with our theoretical predictions on market adjustments due to the mobility of painters. In this section we investigate further on this point in order to highlight which are the factors driving the vanishing of the destination effect. The comparison of the three columns of Table 2 allows us to do this. In all three specifications we enter a set of dummy variables for the main destinations (Verona and Vicenza, Bergamo, Padua, and Treviso), a dummy variable for the other minor provincial destinations of the Venetian Republic and a dummy for exports. Venice is the reference group.

Results from estimation of the most parsimonious price equation containing only the dummies for destination and size of paintings show that on average paintings addressed to Verona and Vicenza and to small provincial centres were considerably less valued than paintings produced for Venice, even controlling for size (- 34% for Verona and Vicenza and - 29% for minor towns). On the contrary, we detect a positive premium for export sales, as witnessed by the positive and large sign of the coefficient of the dummy for exports (+ 57%). For the other main towns of the Republic, that is Bergamo, Treviso and Padua, we do not find a differential in prices per square meter with respect to Venice.[25]

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[25] In particular, Bergamo did exhibit total prices that were higher than in Venice, as emphasized by Spear and Sohm (2010), but simply controlling for the size of paintings, the difference looses its significance.

In order to see what is the role of the differences between features of paintings addressed to different destinations, in column 2 we show destinations' dummies coefficients obtained after controlling for paintings' characteristics. What we find is that the negative price differentials registered for minor centres and for Verona and Vicenza persists, but the export premium halves and looses its statistical significance, suggesting that the price differential detected before was partly due to the fact that exported paintings possessed more characteristics that were more valued by the market than those produced for Venice.

Finally, if we consider the high mobility of painters that characterized the Venetian market for art in the period under analysis, we expect that after controlling for painters' characteristics any price differential disappears. In effect, the comparison of results in columns 2 and 3 reveals that minor centres' as well as paintings for Verona and Vicenza were paid less because they were produced by lower quality painters, so that when controlling for painters' quality the differential disappears.[26] Our result is consistent with the hypothesis that the structure of this market was endogenous in general equilibrium and painters' (or paintings') mobility was arbitraging away price differentials between towns with different demand sizes. In a dynamic perspective, any price differential should induce painters to move toward high price destinations (or send their works there), which would tend to put downward pressure on the prices of those destinations and to increase the prices of the other ones (see Etro and Colciago, 2010, for a recent investigation of endogenous market structures in general equilibrium models). Moreover, exported paintings were not paid more in absolute terms, but foreign commissioners were simply selecting higher quality paintings by high quality painters.

On the other hand, aggregate shocks affecting demand everywhere should have influenced equilibrium prices in each town. We confirm this result looking at the coefficient of the dummy variable for the decade following the 1630 plague, which shows a drastic and sizable reduction in the average prices (- 59 %).

In conclusion, aggregate shocks affected prices, while local shocks tended to generate market adjustments associated with endogenous entry of painters driven by profitability, which eliminated price differentials.

4. The Market in Central Italy

Our next aim is to extend our analysis to the other art centers of Central Italy which were extremely interconnected from a political, economic and artistic point of view since Renaissance, that is Rome, Florence, Bologna and Naples. Also in this case the source of data is Spear and Sohm (2010), from which we derive information on the original sale prices and on other characteristics of 241 religious commissions traded during the Baroque period and produced by 93 artists.

We conduct a distinct empirical analysis for Central Italy because Rome, Bologna, Florence and Naples appear to belong to a largely integrated market with profound differences from the Venetian Republic in terms of artistic tradition (and therefore demand preferences) and even economic links (and therefore trade integration). Moreover, the period to which the data refer is much narrower than in the case of Venice (we observe prices of paintings bargained only in the XVII century) and because we have a more limited set of explanatory variables (for instance the data do not provide information relative to the planned position, altar, ceiling or wall). Moreover, the paintings in the dataset refer exclusively to bargaining between artists and religious commissioners (contrary to the dataset for the Venetian Republic, the dataset on Central Italy does not contain secular commissioners).

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[26] A limit of our analysis is the lack of wide evidence on the paintings produced by artists active in minor towns and in the countryside. However, if price equalization did hold between heterogeneous painters arrived from everywhere to Venice and producing for different destinations, it is likely to hold also for painters producing for the same destinations outside Venice. We are grateful to the Editor for pointing this out.

Prices of paintings for each city have been converted in the local contemporary silver coins by Spear and Sohm (2010). More specifically, for Rome and Florence they are expressed in their own silver scudi, for Bologna in liras, which can be immediately converted in silver scudi, and for Naples in silver ducats. All the silver coins were exchanged almost at parity between each other, and, most important for our purposes, without increasing deviations over time. During the XVII century inflationary phenomena were virtually absent in Central Italy,[27] therefore correcting prices for the cost of living has negligible impact on the price series. Nevertheless, we introduce dummies for prices in the currencies of the four cities and a time trend to control for residual differences between average prices in different cities and for inflationary trends.

Table 3 shows some key features of the whole sample and by town. Notice that 60 % of the paintings were from Rome, which was indeed the leading art center, 17 % from Bologna, 16 % from Naples and 7 % from Florence. However, many painters were active both in Rome and in at least another of these towns (as for Reni, Guercino, Domenichino or Caravaggio). The average age at which commissions were decided is a few years below the one for the Venetian Republic (also because this dataset contains more altarpieces which required multiple years of work that are not reflected in the age at the time of the initial commission). The main explanatory variables are the same as before, including the size of paintings and the number of figures, which are smaller on average than in the Venetian Republic. Since we do not have systematic information on the positioning of the paintings (altar, wall, ceiling), we did build dummies for the subjects of the paintings (including those for the presence of Christ or the Virgin in the composition, Old versus New Testament stories, and so on), which were often related to the placement of the painting in the churches. Moreover, we can classify a particular category of altarpieces, that is the altarpieces commissioned by the Popes for the decoration of the Saint Peter's.

To study the relationship between destinations and the price of paintings, we relied on a conservative test. We built a dummy variable, Minor destination, which includes all the smallest destinations different from the four main towns and the other leading art centers as Genoa or cities outside Italy (exchanges with the Venetian Republic appear actually limited, in support with our thesis that these were two distinct market from an artistic and economic point of view, at least during the XVII century). We have experimented different definitions, including only the small towns in the countryside (as in the Table 2), or even larger provincial towns as Ancona, Lucca or Perugia (all together representing 25 % of the observations). If none of these definitions of Minor destinations exhibits lower prices than the main cities (after controlling for paintings' and painters' features), we cannot reject the thesis for which market forces led to price equalization.

Table 3

Summary statistics – Central Italy

Variables	All		Rome		Florence		Bologna		Naples	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Price	320.55	394.64	326.20	329.11	201.94	127.57	412.75	641.27	258.13	357.15
Size	8.95	7.08	9.06	8.10	6.90	2.20	10.39	6.55	7.99	4.21
Number of figures	6.44	3.74	5.95	3.55	6.28	2.97	7.23	5.04	7.53	2.85
Age	43.93	12.70	43.34	13.52	47.83	11.92	43.53	13.17	44.71	8.79
Observations	241		145		18		40		38	

Finally, we checked for a time trend and for a macroeconomic shock identical to the one evaluated in the analysis of Venice: the plague of 1630 did not reach the towns below the Appenini

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[27] To give a couple of examples from Rome, where the scudo was divided in 100 baiocchi, the price per 12-oz. pound of cow's milk cheese was 7 baiocchi in 1595 and 7.5 in1701; the price of sausages was 10 baiocchi in 1595 and 9 in 1701, and identical stable prices characterized all the common food products (Spear and Sohm, 2010).

mountains, but another plague hit Rome, Florence and Naples in 1656. As before, we checked for this aggregate demand shock by means of a dummy variable for the decade immediately following the plague (1656-1665).

4.1 Empirical analysis

Estimation results are in Table 4 and they largely confirm the pattern of price determination detected for Northern Italy. Also in this case, the high value of the R^2 (66 %) points out a good overall fit of the model. First of all, the value of paintings continues to be strongly related to their objective features: the return to size is similar to what we found for Venice (around 11% per square meter). We find again evidence of economies of scale.

The number of figures is still positively related to the price but its coefficient is much larger than for Venetian paintings. In that case we found that prices on average increased by 3% per figure, while now we find that each figure brings a growth in price of around 17%. Therefore, we confirm the evidence of a contractual solution to the moral hazard problem between patrons and artists through prices depending on the number of figures. The higher marginal impact of the number of figures is consistent with the stronger evidence of pricing per figure between Bolognese artists such as Guercino, Reni and Domenichino, all of whom spread their stylistic and contractual influence to both Rome and Naples, and with the larger importance of figure drawing in the artistic tradition of Florence, Rome and Bologna (compared to the accent on color of the Venetian artistic tradition).

While subjects did not affect prices in our analysis of Venice, in the case of the rest of Italy we found that when the subject of the artwork included Christ the painting was paid 22% more (other subject variables were not significant). Such result may depend on the correlation between this particular subject and the position of the painting in the church (for which we cannot control here): the presence of Christ in a painting was more typical of altarpieces (Crucifixion; Nativity; Virgin, Child and Saints, and so on), and for Venice we found that altarpieces were indeed paid more. While we do not have paintings for public buildings, our dataset includes few altarpieces destined to Saint Peter's church: not surprisingly, prices for these altarpieces were much more paid than average. The fact that the painting was part of a multiple commission reduces the prices now.

Let us turn to the destination effects. First of all, one should keep in mind the caveat that here the dummies for the provenance from the four towns (Florence, Naples and Bologna relative to the omitted Rome) reflect small differences in exchange rates between silver coins jointly with additional differences between average prices (and these differences are not significant). Given this, we are interested in evaluating price differentials between paintings destined to the high-demand cities and the minor destinations. The corresponding dummy for Minor destination never has a negative coefficient, either with the wider definition employed here or when we included more restrictive definitions of minor destinations. This suggests that, after controlling for paintings' and painters' features, prices were not higher in Rome and the other main cities compared to the countryside and minor towns. We see this result in support of our general hypothesis for which the mobility of painters, in this case mainly toward the major art centre (Rome), was eliminating price differentials in the Italian market for paintings. Once again, prices were indeed higher in the richest cities, but only because better painters went there and more ambitious commissions were available there: in equilibrium, painters of similar quality were paid the same everywhere for the same commissions. Finally, as before we find that the decade immediately following the plague in Rome, Florence and Naples (1656-1665) was characterized by a strong reduction in the prices of art for these three cities (- 45%), another result in line with what found for the Venetian Republic.

Last, we move to painters' specific variables. As to artist fixed-effects, Trevisani, the least paid painter, is the omitted category. Cortona, Sacchi and Maratta were the most famous figurative artists of the Baroque age and appear to be the best paid, immediately followed by Caravaggio, less

appreciated than nowadays, and the Bolognese masters as Reni and Domenichino. The next section discusses the age-price profile emerging for these painters.

Table 4

Log of Prices – Central Italy

Independent variables			
PAINTINGS' CHARACTERISTICS			
Size	0.108	***	(0.025)
Squared size	-0.002	***	(0.001)
Nr figures	0.172	***	(0.043)
Squared Nr figures	-0.006	***	(0.002)
Multiple commission	-0.436	**	(0.204)
Christ	0.221	**	(0.106)
Florence	-0.061		(0.201)
Naples	0.025		(0.180)
Bologna	-0.024		(0.174)
Saint Peter's	0.507	***	(0.171)
Minor destination	0.105		(0.152)
PAINTER'S CHARACTERISTICS			
Age	0.092	***	(0.025)
Squared age	-0.001	***	(0.000)
Sacchi	0.895	***	(0.334)
Arpino	0.429		(0.319)
Baglione	0.780	**	(0.339)
Caracciolo	0.033		(0.366)
Caravaggio	0.642	***	(0.246)
Carracci L.	-0.654	*	(0.349)
Cortona	0.798	***	(0.234)
Domenichino	0.688	***	(0.254)
Gaulli	0.225		(0.356)
Gimignani G.	-0.175		(0.295)
Giordano	0.063		(0.347)
Lanfranco	0.157		(0.285)
Maratta	0.775	***	(0.274)
Passignano	0.423		(0.322)
Preti	0.097		(0.352)
Reni	0.552	**	(0.225)
Romanelli	0.303		(0.328)
Roncalli	-0.069		(0.321)
Rosselli	-0.048		(0.381)
Tiarini	-0.214		(0.293)
Others	-0.026		(0.687)
OTHER			
Date	0.002		(0.003)
Plague	-0.451	**	(0.224)
Constant	-1.780		(4.128)
Observations	241		
R-squared	0.659		

*Notes.* Standard errors in parentheses. Reference categories: Subject≠Christ, Destination=Rome, Painter=Trevisani

*** p<0.01, ** p<0.05, * p<0.1

4.2 The Galenson hypothesis

The positive relation between age of painters and price of paintings previously ascertained for Venetian art is even stronger in Central Italy, as suggested by the larger coefficient of age (9% a year versus 3%). In this case we also observe slightly decreasing returns to age. Such a result is clearly shown in Figure 1, which describes the age-price profile. More specifically, the figure plots the residuals obtained after regressing the logarithm of price over all explanatory variables included in the full specification described in Table 4 with the exception of age and its square. The figure confirms the positive and concave relationship between age of painters and prices of paintings, which reaches its maximum at the age of sixty-two (well above the average of forty-four at which paintings are executed) and it starts decreasing afterwards.

The estimates suggest that the Baroque age included many experimental innovators in the Galenson's terminology, that is artists able to develop their skills to produce works of increasing quality through experience and reach their best production at a late age. In order to obtain additional evidence on the Galenson hypothesis, Figure 2 reports the life cycle of the price per square meter for some famous and high-quality painters of different generations: Tintoretto and Ricci from Venice and Reni and Domenichino from Bologna. For all of them a discernible increasing path of the normalized price of paintings is clearly visible. Most interestingly, all of them could be seen as belonging to the category of experimental painters in the Galenson's terminology. Leaving additional investigations for art historical research, we can add a few remarks on the careers of some of these painters.

Figure 1: Age-price profile
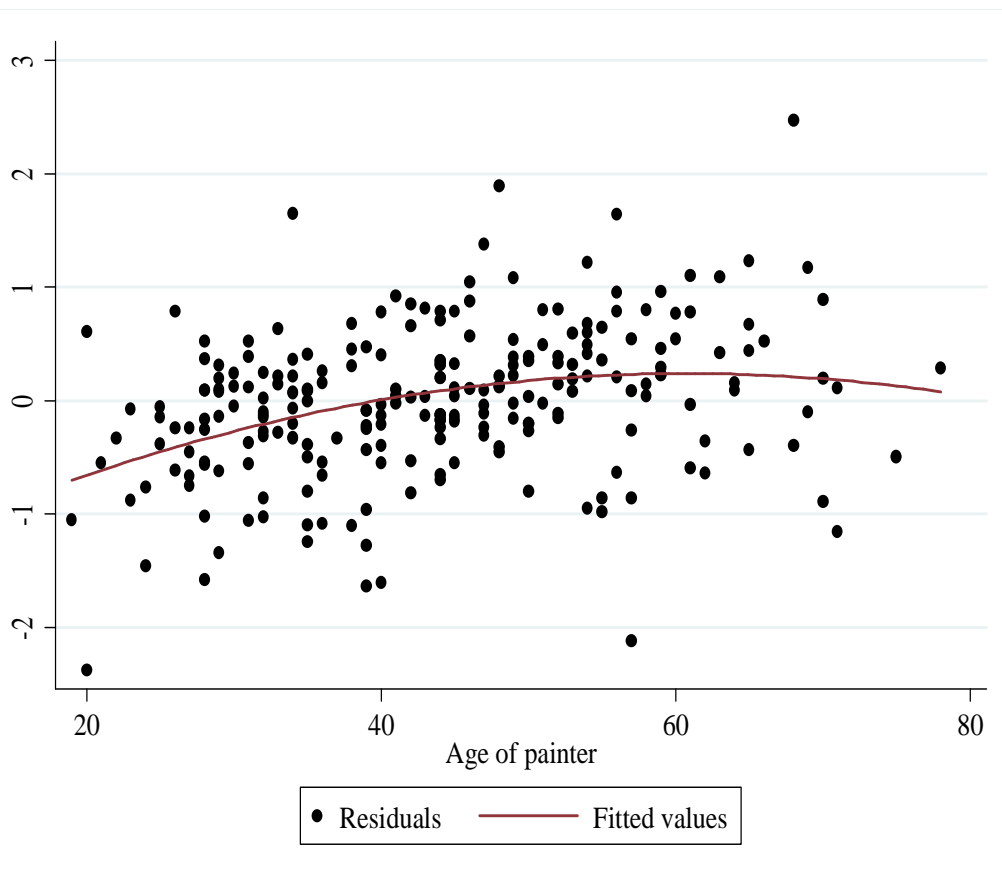
Tintoretto developed his style during the second half of the XVI century in competition with the older Titian, and his sketchy technique gave him an impressionistic device to create powerful theatrical images throughout his entire career, until the last year of his life in which, seventy-six years old, he completed one of his masterpieces, the Last Supper (S. Giorgio Maggiore, Venice).

Sebastiano Ricci is probably less famous than Tiepolo, the leading Venetian painter of the XVIII century, but was the real starter of the Venetian renaissance in the Rococò period (after a century of artistic provincialism repeating the style of the older Venetian masters), traveling across all Europe and absorbing and rielaborating in an original way the most advanced international experiences of his time. One of the leading experts of Venetian art talks about a "sviluppo lento" (slow development) of Ricci's style.[29] The majority of his works, and all the most famous ones are posterior to 1700 (when he was more than forty), which clearly points toward experimentalism in the sense of Galenson. Also the two leading Bolognese painters active in Central Italy experienced a deep and long evolution toward an ideal classicism which led them to increasing fame and appreciation. Guido Reni reached his maturity when back in Bologna after more than a decade spent in Rome (and the initial apprenticeship in Bologna). His own words may be the best witnesses of his constant experimentalism: "*the most beautiful painting is the one I am doing, and if tomorrow I will do another, it will be that one*." Also Domenichino improved his style in a long activity in Rome, but he reached his maximum achievements in the last decade of his life, almost entirely dedicated to the frescoes for the Cathedral of Naples.

Figure 2: Age-price profile for selected top quality painters
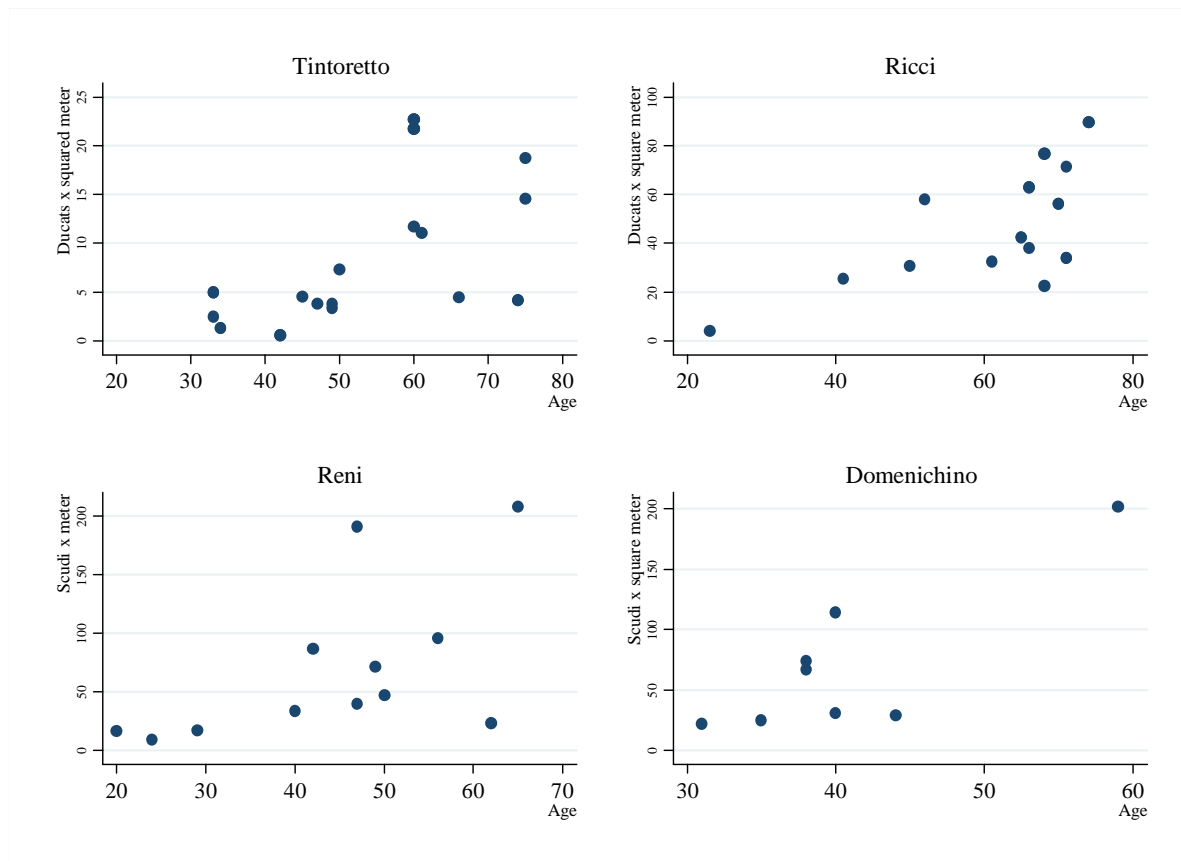
Caravaggio followed a completely different path throughout his career. He moved from Milan to Rome without much experience, and rather than learning the mannerist style of his initial master Arpino (celebrated and well paid at the time, virtually forgotten today), he approached painting from a new and different perspective. Caravaggio was revolutionary in many ways: introducing (and giving unprecedented dignity to) new subjects as still lifes and genre paintings, adopting a new way to bring external light into the pictures, and pursuing extreme realism beyond anyone had ever done. All of these innovations emerged immediately in the early works during his twenties, as in the famous still life of the Basket of Fruits (Pinacoteca Ambrosiana, Milan) and the

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[29] See Pallucchini, R., 1981, Pittura Veneziana del Seicento, Milan: Electa.

Fortune Teller (Louvre, Paris) executed when about twenty-five, or in famous altarpieces as The Calling of St. Matthew (S. Luigi dei Francesi, Rome), executed at the age of twenty-eight. His later works are considered equally valuable, but less innovative. Even looking at Caravaggio's compensations we do not find any increasing pattern with age. Besides being moderately priced from the beginning, Caravaggio was not perceived as improving his quality or innovating during his career. Figure 3 shows the price per square meter of his altarpieces included in our dataset: if anything, the erratic path is in line with the hypothesis that we are in front of a conceptual innovator in the terminology of Galenson (2006).

Sebastiano Ricci: Susanna before Daniel (1724), Galleria Sabauda, Turin

5. Conclusion

Westudied the Italian market for oil paintings of historical subject during the Baroque era through econometric analysis of a unique dataset containing the prices derived from the original contracts. Our main purpose was to show that looking at the market for paintings as a fully fledged market and analyzing the contractual aspects of its deals and the endogeneity of its structure could shed light on the determination of the prices of some of the most valuable handmade objects of humankind.

The market for oil paintings was extremely competitive and populated by players very similar to what we may now define as representatives of the *homo economicus*. They developed forms of horizontal and vertical differentiation which created separate markets where demand and supply conditions clearly affected equilibrium prices.[30] They solved contractual problems between patrons (principals) and artists (agents) as we would expect in the presence of unverifiable quality and moral hazard: conditioning payments on measurable variables related to quality, as the number of figures depicted. They migrated between art markets trying to exploit opportunities for extra profits, to the point of eliminating any price differential in equilibrium. And they exploited their experience to innovate and increase their market power.

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[30] The role of genre differentiation in the market for paintings remain a crucial aspect to study.

Figure 3: Age-price profile for a conceptual innovator
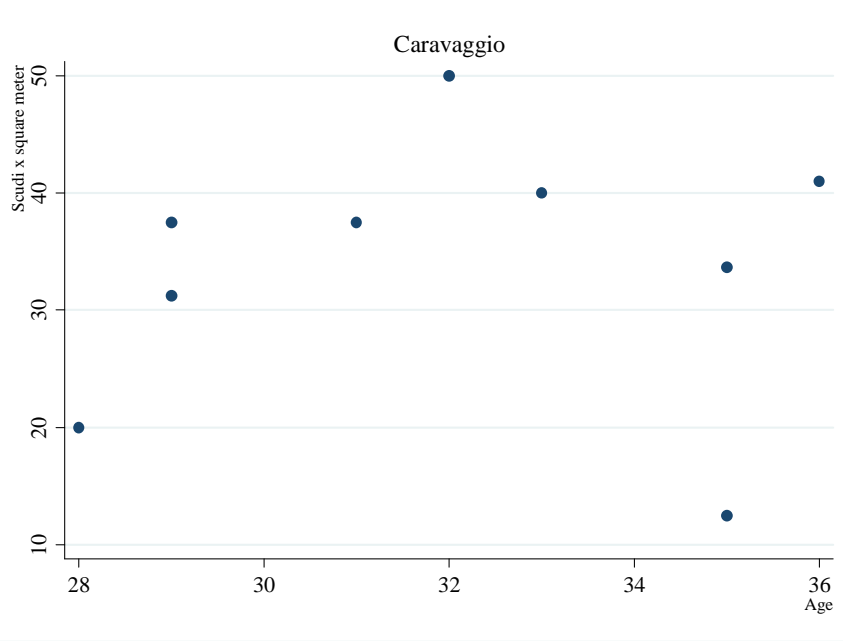
In a celebrated historical account of the demand for art in the Renaissance period, Goldthwaite (1993) has pointed out that Italian cities have generated the first modern markets for durable luxury goods, which have been at the origins of modern capitalism based on consumerism. "Today the consumer instinct is taken for granted: the challenge to producers is to introduce new products, reduce prices, and change fashion... If, on the one hand, we decry what this consumerism has developed into in our own times, with its commodity culture of planned obsolescence, throwaway goods, and fashion-ridden boutiques, on the other hand we have enshrined its very spirit in our great museums. These veritable temples to the consumption habits of the past, where we worship as art one of the dynamics that gives life to the economic system of the West, mark the supreme achievement of capitalism" (pp. 253-254). The market for paintings in the XVI-XVIII century is not only one of the first markets for durable luxury goods of the modern capitalistic society. Its surviving documentary evidence and even its surviving products are witnesses that it was also one of the first manufacturing markets to follow the main laws of economics and rational market behavior.

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