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**Federico Etro and Elena
Stepanova**

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the Netherlands during the
Seventeenth Century**

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The Market for Paintings in the Netherlands during the Seventeenth Century

Federico Etro

University of Venice, Ca' Foscari
and

Elena Stepanova

S. Anna School of Advanced Studies, Pisa

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Abstract

We analyze the price of paintings in Dutch inventories and auctions of the Golden Age. The econometric investigation emphasizes correlations between prices adjusted for inflation and characteristics of the paintings, of the painters, of the owners (job, religion, size of the house) and, in case of auctions, also of the buyers. Price differentials for alternative genres, for the characteristics of the traders and the purpose of the inventory tend to disappear after controlling for the unobservable quality of paintings with artists fixed effects. The real price of a representative painting declined over the XVII century. We argue that initial high prices were the fruit of the large increase in demand by the Dutch middle class, which attracted endogenous entry of painters. This led to intense competition and the development of cost-saving innovations for mass production (high specialization in genres, smaller paintings, monochromatic styles) so as to gradually reduce prices. We also run a multinomial probit model to verify the Montias hypothesis on the location of paintings between rooms of Dutch houses.

Keywords

Art market, Endogenous entry, Dutch Golden Age Hedonic pricing analysis

JEL Codes

Z11, N0, D4

Address for correspondence:

Federico Etro

Department of Economics
Ca' Foscari University of Venice
Cannaregio 873, Fondamenta S.Giobbe
30121 Venezia - Italy
Phone: (+39) 041 2349172
Fax: (+39) 041 2349176
e-mail: federico.etro@unive.it

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1. Introduction

Recent research from multiple fields, including economic history, art history and cultural economics, has been focused on the organization of historical markets for paintings, mainly in Italy and the Low Countries during the XVII century for both the primary market (for instance see Haskell, 1982; North, 1999; Spear and Sohm, 2010; Etro and Pagani, 2012) and the secondary market, with the pioneering work of John Montias. Systematic investigations of manuscripts found in archives have been focused on inventories in Delft (Montias, 1982) and in Amsterdam and Dordrecht (Loughman and Montias, 2001), and on auctions in Amsterdam (Montias, 2002), while subsequent scholars have extended the analysis to inventories in Venice (Cecchini, 2000), Antwerp (Martens and Peeters, 2006) and elsewhere. Most of these studies establish a number of interesting stylized facts and provide descriptive statistics on the paintings found in houses and traded in auctions (for surveys see De Marchi and Van Miegroet, 2006,a,b), but they lack a rigorous econometric investigation able to establish more solid patterns on the determinants of prices adjusted for inflation and controlling for a number of factors related to demand and supply.

In this work we provide a first econometric examination of the secondary market for paintings by Dutch and Flemish painters in the XVII century emerging indirectly from inventories from Amsterdam, Dordrecht, Harleem and Utrecht, and directly from auctions in Amsterdam.¹ The dataset puts together information collected at the Frick Collection research center and the Getty Research Institute which was initially and mainly obtained by John Montias in his investigations on manuscripts found in Dutch archives. We adjust prices with yearly inflation derived from the van Zanden consumer price index built on the basis of multiple price series (see De Vries and van der Woude, 1997).² The econometric investigation determines the relation between the real price of paintings with aggregate variables (the real wage as a control for the business cycle and the time trend to check for the pattern of real prices), characteristics of the paintings (size, originality, attribution), of the painters (their fixed effects as a proxy of quality and year of birth as a proxy of the period of activity), of the collection (purpose of the inventory, average price of its paintings) of the owners (job, religion, number of rooms in their house as a proxy of wealth) and of the buyers for auctions (again job, religion and family relation with the seller).

We verify standard results concerning the price of paintings: smaller paintings, copies, units of multiple paintings evaluated together and anonymous paintings have a lower price. The number of rooms in the house of the owner is a proxy for wealth and is positively related to prices. In both inventories and auctions, price differentials for alternative genres (figuratives, landscapes, genre paintings, still lifes and portraits) and for the characteristics of the traders (jobs and religion) decrease drastically or disappear after controlling for the unobservable quality of paintings with artists fixed effects. Inventories drawn after the death of the owner or for a marriage have higher prices on average than those due to the insolvency of the owner or drawn to build a collateral for a debt, but again these differences disappear after controlling for the artists fixed effects. All these results appear in line with a competitive market that was pricing the quality of the painters independently from the type of painting and the characteristics of the owner. Looking at inventories, we also run a multinomial probit model to verify the Montias hypothesis on the location of paintings between rooms of Dutch houses: public rooms are more likely to have more val-

¹ For classic introduction to the Dutch art of the Golden age see Haak (2003). On the contemporary Flemish art see Vlieghe (1998).

² See <http://www.iisg.nl/hpw/brenv.php#biblio>.

uable paintings than private rooms, the main entrance of the Dutch houses were more likely to have larger and valuable paintings and less likely to have portraits and figurative paintings, while still life paintings were more likely to be in the kitchen.

One of the most interesting results is about the general trend of the price level and its relation with the entry of painters in the market. Earlier investigations based on average nominal prices (Chong, 1987; North, 1999) have shown an increasing trend in the price of Dutch paintings, especially at the end of the century. Controlling for inflation and paintings' characteristics, we actually find evidence of declining real prices. We argue that such a pattern may be the result of entry, competition and innovation in the market. The economic boom and the increasing demand by the Dutch middle class between the end of the XVI century and the beginning of the XVII century determined high prices, which induced a process of endogenous entry of new and innovative painters during the Golden Age. This led to intense competition and the development of cost-saving innovations for mass production, such as high specialization in genres, smaller paintings and monochromatic style. All this led to a slow reduction in the price of the representative painting.

Plate 1: Rembrandt, *The Anatomy Lecture of Dr. Nicolaes Tulp*, 1632, The Hague, Mauritshuis

The paper is organized as follows. In Section 2 we review related studies on inventories and auctions and motivate the analysis. In Section 3 we describe the dataset on inventories from the main Dutch towns. In Section 4 we discuss our basic regression analysis for these inventories. Section 5 provides a multinomial probit model used to analyze the allocation of paintings between rooms in Dutch houses. Section 6 provides additional support to our result with a regression analysis on the auctions of paintings in Amsterdam. Finally, Section 7 concludes.

2. Overview and related literature

The Netherlands became the dominant economic power during the XVII century, with a leadership in shipbuilding, the textile industry, selected manufacturing sectors and international trade.³ The Dutch middle class was becoming richer than in any other country. The real wage of the working class increased at the end of the XVI century and the beginning of the XVII century, and then kept oscillating on a stationary trend (De Vries and van der Woude, 1997). We have excellent information on price series and wage series for this period, summarized in the dataset build by Jan Luiten van Zanden at the International Institute of Social History.⁴ De Vries and van der Woude (1997) have collected data on nominal wages of building workers, and price series (mainly from records of hospitals, chapters and orphanages in Amsterdam, Leiden and Utrecht) are available for bread, potato, beer, herring, stockfish, peas, butter, turf, linen, textile, soap, paper, pepper, sugar and house rent. This has allowed van Zanden to build the yearly CPI and the real wage index shown in Fig. 1 and used in our work to compute the real price of paintings.⁵

Fig. 1 Real wages and Consumer Price Index in the Dutch Republic

The increasing demand of art by the Dutch middle class attracted painters in all the main Dutch towns during the end of the XVI century and the first part of the XVII century. Beside immigrant artists from the Flanders, where a solid artistic tradition was already established, the occupational choice of starting the career of painter became more common in the Dutch labor market. Entry into the art market required a six-year apprenticeship which was rather costly for the family in terms of fees and forgone earnings.⁶ Montias (1982) has noticed that a large but de-

³ This was possible thanks to high human capital and readily available investments (with an advanced financial market), high levels of urbanization, an extensive use of energy sources (turf and wind) and superior technologies (North, 1999). Agriculture and fishing were already employing a minority of the population, and the Dutch society was the first to move from an aristocratic to a bourgeois society.

⁴ Available from the website <http://www.iisg.nl/hpw/brenv.php>

⁵ The graph emphasizes a heavy decline in the real wage in the twenties associated with the recommencement of the Eighty Years' War with Spain in 1621, and others associated with inflationary periods. Notice that the famous speculative bubble known as *tulip mania*, which took place in 1637, does not seem to have particular consequences on the general inflation.

⁶ Some pupils paid up to a hundred guilders a year (excluding board and lodging) to be trained by masters as Rembrandt, Honthorst or Dou (North, 1999, p. 65). To have an idea of the size of such an investment, Montias (1982) cal-

creasing fraction of the painters were sons of artists, and the remaining and increasing part from the low and middle class, which suggests that talent was gradually becoming more important than family tradition. After this investment in human capital (often complemented with an artistic tour to Italy), the head of the Guild of St Luke recognized the status of journeyman with the right to sign and sell paintings in town. The objective of the guilds was to protect the income of the affiliates, for instance trying to restrict the number of painters, the activity of foreign artists and the frequency of public sales (auctions and lotteries), but in a large town like Amsterdam competition was strong and it was even hard for the guild to control the membership of the painters active in town.⁷ The artistic profession could be remunerative for the successful painters: Montias (1982) estimates that Dutch artists of the Golden age probably had an average net income between 1150 and 1400 guilders, three times as much as a master carpenter, and more than other high skilled craftsmen.⁸

Since the end of the XVI century Dutch and Flemish painters started to specialize in a single genre, such as still life, portrait, landscape, genre painting or figurative painting. Realism and metaphorical meanings were the main objectives of their work and what buyers were demanding.⁹ Painters mainly worked for an anonymous market, except for the portraitists and few important masters that occasionally worked on direct commissions. Those coming from the House of Orange in The Hague were rare but generous: Rembrandt received 600 guilders for each of five large paintings for the *stadholder* (the viceroy of the king of Spain). Public authorities occasionally commissioned monumental paintings: Ferdinand Bol, Jan Lievens and Govert Flink received 1500 guilders for each painting prepared for the Amsterdam Town Hall. More frequent were the commissions for group portraits: for instance, Frans Hals received 960 guilders for the sixteen portraits of the officers of the Amsterdam Crossbow Militia Guild. Most portraitists were however engaged in single figure portraits: for instance, Rembrandt was used to ask fifty guilders for a head and up to five hundred for a full length portrait. The vast majority of the painters sold their works in their studios, through art dealers, at exhibitions and sales organized by the guild and at lotteries.¹⁰ Unfortunately, for this primary market we do not have systematic information on the prices of the paintings. What we know a lot about, instead, is the secondary market of the auctions and indirectly of the evaluations in inventories, on which we will focus in the rest of the paper.

Earlier analysis of paintings listed in historical inventories have established a number of interesting facts that we will verify econometrically. Investigations up to the XVI century are limited by the scarce number of available inventories arrived to our days and the limited descriptions of the same paintings. Martens and Peeters (2006) have looked at judicial inventories of confiscated goods in Antwerp before iconoclasm took place around 1566. Most houses had a high number of paintings, especially in the public rooms (as the *voorcamer*, the front room). The number of rooms in the house, which is a proxy for the wealth of the owner, appears to be positively corre-

culates that artists in Delft paid an average rent of 142 guilders a year, and bought houses of an average price of 1785 guilders.

⁷ Rembrandt did not enroll in the guild, and when he went bankrupt he could not enjoy the transfers that other painters did receive from the guild members.

⁸ Remarkably, a painter and art historian of the following century, Jan van Gool, complained that at the beginning of the XVIII century even the best Dutch painters could scarcely earn twice as much as a carpenter. In his “Nieuw Schouburg” (The Hague, 1750), van Gool admits the reduced quality of the contemporary art, but blames it on the influence of the art dealers that promoted only sales of paintings from the Golden age (see Slive, 1995, p. 297).

⁹ A wide art historical literature debates on the relevance of the symbolic (iconographic and iconological) interpretation of Dutch paintings (de Jongh, 2000) *versus* the realistic (descriptive) interpretation (Alpers, 1983; Hochstrasser, 2007).

¹⁰ Painters often used their works to pay creditors: Jan Steen paid an interest on a loan with three portraits, Simon de Vlieger paid a house with monthly deliveries of paintings.

lated with the quantity of paintings. Most of them were of religious subject, with a marginal but increasing presence of portraits, mythological subjects and landscapes, and the appearance of the first genres pictures. Common descriptions included whether the painting was small or large, but attributions to painters and price evaluations were entirely absent. Remarkably, the investigation by one of us on the few Venetian death inventories left from the XVI century provides a very similar picture.¹¹

The first systematic investigation of Dutch paintings of the XVII century is due to Montias (1982), who examined inventories and auctions drawn from notarial records and estate papers of the Orphan Chamber in Delft between 1610 and 1679. He explored the handwritten description of almost nineteen thousand paintings, whose subject was established for almost ten thousand, with attributions to painters for about two thousand. Half of the 1224 inventories contained information on prices. The main finding of the study was that the composition of the collections changed drastically during the century: while half of the paintings were figurative in the first decade (1610-1619), a quarter were landscapes and a sixth were portraits, with a marginal presence of still life and genre paintings, in the last decade under consideration (1670-1679) landscapes represented 40.9% of the paintings, still life paintings represented 16.7%, all the figurative paintings represented 16.6%, portraits and *tronyen* (small faces) represented 15% and genre paintings reached 7.4% of all the paintings (with the rest unclassified).¹² Montias emphasized a large proportion of Delft-based painters mentioned in the inventories, and a marginal presence of Flemish painters, suggesting a certain provincial taste between Delft collectors. The attributed paintings had an average price of 16.6 guilders against 7.2 guilders for the average anonymous painting.¹³ We will verify these trends in OLS regressions on our enlarged dataset, which includes inventories not only from Amsterdam, but also from other main towns such as Haarlem, Dordrecht and Utrecht.

Loughman and Montias (2001) have analyzed 273 inventories from Amsterdam in the period 1600-1679. However, their interest is entirely on the allocation of paintings (and other artworks) within the Dutch houses. They have emphasized that the *voorhuys* (the entrance of a Dutch house) and public rooms contained the most valuable paintings. Moreover, they run Chi-square tests to show that public rooms were more likely to contain larger paintings, attributed paintings and paintings with a description of the subject. Nevertheless, without controlling for multiple characteristics simultaneously, they were unable to draw strong inferences on the distribution of genres across rooms: the *voorhuys* is more likely to contain mythological paintings and political portraits in the first half of the century and landscapes in the second half, the other public rooms are more likely to contain respectively still life and genre paintings, and the private rooms are more likely to contain family portraits. We will provide a more systematic investigation of the relation between paintings features and their prices and placement within Dutch houses running a multinomial probit analysis.

¹¹ Etro has investigated inventories from the *Fondo della Cancelleria Inferior* in the series "Miscellanea" of different notaries (buste 34-45), at the *Archivio di Stato* in Venice. Niero (2012) provides a brief description of these inventories. Most houses contained a wide number of paintings, especially in the *portego*, the main public room, mostly of religious subject with a small number of portraits, landscapes, often imported from the Flanders, and, more rarely, mythological subjects. A description of the frame and of whether the painting was small or large were common, while attributions to painters were almost always absent. Price evaluations by the notary are often present, but they were usually hard to interpret. Similar patterns persist during the XVII century, whose inventories were investigated by Cecchini (2000).

¹² See Table 8.3 in Montias (1982).

¹³ Montias provided also a regression of the logprice of the value of art collections on a time trend and on the logarithm of the total value of the inventories as a proxy of the wealth of the art collectors. There was no evidence of a significant time trend, while the wealth elasticity was estimated at 1.23 (with a standard error of 0.052), suggesting that wealthier collectors were significantly increasing their share of artworks in their holdings.

The first systematic analysis of Dutch auctions is due to Montias (2002), who collected a dataset on auctions of the Orphan Chamber of Amsterdam between 1597 and 1638. His analysis has put together an impressive amount of information on the sellers and on the buyers, on the social networks emerging between them, and on the trade of all the art objects (not just paintings). In the early period (1597-1619) his records have a similar composition as in the contemporary Delft inventories: 42% are figurative paintings, 21.3% are landscapes, 18,7% are portraits, 8.4% are still life paintings and 6.1% are genre paintings. However, the limited time period taken in consideration and the lack of an econometric investigation did not allow Montias (2002) to extrapolate additional patterns in the data: this will be the aim of our investigation which will cover an enlarged dataset with auctions from a later phase of the century in Amsterdam.¹⁴

Fig. 2 Number of painters in all the Dutch and Flemish towns (right scale) and selected towns (left scale)

Our econometric analysis will confirm most of the insights advanced by the early literature on more solid grounds, including the relation between objective characteristics of the paintings (size, originality and genre) and their price or their placement in the house of the owner, and it will investigate additional economic hypothesis. The most intriguing result that we will emphasize in both inventories and auctions is the decline of the real price of paintings starting at some point at the beginning of the Golden age. This may be related to the large increase in demand by the middle class taking place at the end of the XVI century and the beginning of the XVII century which attracted a massive entry of painters looking for new opportunities. The initial increase in the number of painters strengthened competition and induced innovations for the mass production of paintings, which in turn may have led to a decline in the real price of paintings. To check for this thesis, first of all we display the number of painters active in Amsterdam, in the four cities for which we have data (Amsterdam, Haarlem, Utrecht and Dordrecht) and in the entire Low Countries (including Flanders). The data are derived from Ecartico¹⁵ (for an interesting descrip-

¹⁴ The Dutch auction market was by far the most advanced during the XVII century (see De Marchi, 1995). Similar auctions of paintings will emerge only at the end of the century in London (Cowan, 2006) and in the following century in Germany (North, 2006). The first auction by Sotheby's will take place in 1744, the first one by Christie's in 1766.

¹⁵ <http://burckhardt.ic.uva.nl/ecartico/database.html>.

tive analysis of these data see Rasterhoff, 2012) and show a very clear pattern: the number of painters increased until the middle of the century and then started decreasing.

Fig. 3 Entry of painters and price of paintings in inventories for cities present in the dataset (10-years moving average)

Plate 2: Goyen, Jan van, *River landscape with a windmill and a ruined castle*, 1644, Paris, Louvre Museum

In Fig. 3 we plot the net entry of painters in the four main cities analyzed in our dataset and the real price over the century (smoothing both with a moving average): the correlation is remarkable (68%), suggesting that prices were associated with, and possibly did drive, the entry of new painters in the art market. Whether this was the case or not, the increasing number of painters must have strengthened competition, putting downward pressure on prices. Moreover, it may have induced the artistic innovations of the Golden Age, many of which were cost-saving innovations and therefore contributed to reduce prices.

There is a wide anecdotic evidence on how competition and artistic innovations increased the productivity of Dutch painters. The first factor was genre specialization: many painters specialized so much to paint not just in the same genre (for instance still life) but also in the same sub-genre (for instance flowers or fish) and sometimes they even repeated the same compositions learning how to save a lot of time to reach a given quality level. The second factor was the introduction of cost-reducing innovations. For instance, the landscapists Esaias van de Velde and Jan Porcellis introduced the rapid monochromatic (tonal) style. The same monochromatic style was also adopted by many still life painters (Willem Claesz. Heda) and even in figurative paintings by the same Rembrandt (Plate 1). Its main diffusion, however, was in the landscapes, where it was taken to the extreme by Jan van Goyen (Plate 2), Salomon van Ruysdael and Pieter de Molijn: they were said to take only one day to paint their best pictures and were then able to reduce their prices. Third, the general size of paintings was also reduced on average for all the subjects, especially landscapes and genre paintings, which reduced costs and prices: to verify this we expect an increase in the amount of small paintings in the collections. These three main factors led to a reduction of the price of a representative painting in the primary market and, as a consequence in the secondary market as well.

All these developments suggest that we need to control for the observable and unobservable characteristics of the paintings and the timing of their execution to conclude that there was a declining path of the real price of a representative painting during the Golden Age, and that this could be the consequence of intensified competition and innovation. Unfortunately, it is not immediate to use our data from the secondary market to do this, because we have information on objective characteristics of the paintings evaluated in inventories and auctions, but in most cases we do not know the author of the paintings and we have no way of recovering the year in which they were executed. Nevertheless, we have some additional information for the attributed paintings, because we know who executed the painting and the period in which each painter was active. Therefore, in our empirical investigation on the determinants of the price of paintings, we will focus on the attributed paintings to control for their unobservable features through the artist fixed effects and for the period in which they were executed through the year of birth of the painters. On one side we expect that the real price of paintings should be increasing with the time in which painters started working since the last decades of the XVI century: this would reflect the increasing opportunities that attracted entry at the origins of the Golden Age and subsequently induced the high quality produced by the artists of the Golden Age. On the other side, we expect that the evaluation in the secondary market of a representative painting by a representative painter should be declining during the Golden Age, or at least since the second half of the century: this would reflect the impact of the high number of artists on competition and prices. In other words, quality as priced by the market increased for the painters of the Golden Age, but a pain-

ter of given quality would expect decreasing compensations for his or her paintings due to strong competition and cost-saving innovations.

3. Dutch inventories

In this section we describe the sources used for the construction of our dataset drawn from Dutch inventories and provide a statistical description of the information available. In the construction of our dataset, we rely on two main sources: the inventories collected by John Montias in the archives of Amsterdam, now maintained at the Frick Collection Research Center¹⁶ (hereafter the Montias dataset) and archival inventories dataset administrated by the Getty research institute collected by multiple scholars (hereafter the Getty dataset).¹⁷ The two datasets had overlapping observations which we identified and eliminated. They can be considered as a representative sample of the collections of the middle and high class in the Netherlands, since their survival in archives is due to random reasons, and it is likely that collections of the low class were too small to be notarized (Montias, 1982, p. 223). Prices are in guilders, stuivers and penningen¹⁸ and they were all converted in guilders.

The typical record available from the Montias dataset contains: the name of the artist when known (otherwise the painting is “anonymous”), a description in Dutch of the painting, the value assigned by the appraiser, the room where the painting was placed in the house, the title and the subject category assigned by Montias. Similar information is also available from the Getty dataset, but we had to classify all subjects in a limited number of genres for both datasets in a consistent way. The description of each painting was then translated and analyzed to obtain dummies concerning the size (small or large), the originality (copy) and more. We have also information about the owner of each art collection inventoried. The typical record available from Montias dataset contains the following information: date of the inventory, city, purpose of the inventory, name of the owner with biographical details, occupation and religious views and the name of the notary and the appraiser. The Getty dataset contains less information: we are only aware of the name of the owner, the year of the inventory and the city. From the original datasets we selected only inventories that had priced paintings obtaining 684 inventories containing 17715 paintings (7539 paintings or 43% of our data are from the Montias dataset).¹⁹ To have an idea of size of these collections, Fig. 4 reports the distribution of the number of paintings per inventory: the large majority contained less then thirty paintings, but there is also a large group with more than a hundred paintings.

A preliminary look at the data shows that the number of paintings per household increases during the century (see Fig. 5), showing that Dutch houses kept accumulating artworks.²⁰ In the dataset 16% of the paintings are attributed to known artists (their average price is 36 guilders), 3

¹⁶ Available from the website <http://research.frick.org/montias/home.php>

¹⁷ Available from the website <http://piprod.getty.edu/starweb/pi/servlet.starweb>

¹⁸ Prices are in guilders and are usually expressed as in the following example: *f*2: 4: 6. This should be read as 2 guilders, 4 stuivers and 6 penningen. A guilder is abbreviated as *f*, there are 20 stuivers (st.) in a guilder and 16 penningen (pen.) in a stuiver. Therefore the price above corresponds to approximately 2.22 guilders.

¹⁹ We exclude the rare paintings of artists active in Italy as we want to limit our study to local supply of artworks and so we do not consider imported works (whose originality is often dubious). We also exclude from the regressions the authors who are not clearly identifiable, for instance those reported with a monogram that cannot be easily associated to a precise artist.

²⁰ This confirms Montias (1982, Table 8.3) observation for Delft inventories.

% of paintings have an uncertain attribution and were eliminated (the average price of such works is 18.6 guilders) and 81 % of paintings are anonymous (their average price is 7 guilders).²¹

Fig. 4 Sizes of art collections

Fig. 5 Average number of paintings per inventory (10-years moving average)

While the Montias dataset is limited to Amsterdam, the Getty dataset allows us to obtain information on inventories from other important towns such as Haarlem, Utrecht and Dordrecht.

²¹ The Getty dataset contains 12% attributed paintings and 83% anonymous paintings, while in the Montias dataset these shares are 21% and 78%.

The majority of paintings are from Amsterdam (73% of the attributed ones and 59% of the others), followed by Haarlem (15% of the attributed, 25% of the others), Utrecht (8% and 7% respectively) and Dordrecht (4% and 8%). In terms of distribution over time, 75% of our observations belong to the second half of the century (as shown in detail in Fig. 7).

The art value of the collections of paintings varies from 0.75 guilders to 36724 guilders²² with an average value of 323 guilders and a median value of 90 guilders.²³ Remarkably, the majority of the collections (58%) have an average price below 5 guilders and 95% of collections have an average price below 35 guilders, which confirms the idea that this was a mass market. The small paintings had a much lower price on average. Most important, the fraction of small paintings increased dramatically in the inventories during the century, but the fraction of large paintings remains constant. While the qualitative classification of size as drawn from the descriptions is to some extent approximate, the share of paintings defined as small increases from around 15% to 30-35%, suggesting that there was an impressive reduction of the average size of new paintings (see Fig. 6). This is in line with the hypothesis that painters looked for cost savings innovations including a reduction in the size of their products.

Fig. 6 Share of small and large paintings in inventories (10-years moving average)

In the Montias dataset we are able to control for the purpose of the inventories as well as the occupation and religion of the owners. The purpose of the inventory is indicated for almost all the observations, while the owner religion is known for 52% of the observations and the occupation for 79% of the observations. The most common purpose of the inventories is the division of property between heirs after the death of the owner (5914 observations). Art collections as part of inheritance were assessed normally by qualified appraisers (usually members of the guild of the painters) and certified by a notary. Paintings were assessed also in the case of being pledged as collateral for a loan or other kind of debt (260 observations) and in case of bankruptcy or insol-

²² This is the death inventory of the famous art dealer Johannes de Renialme. It also contains the most valuable painting in our dataset: a Rembrandt estimated 1500 guilders.

²³ To calculate the art value of the collections we took into account also the imported works and those of uncertain attribution.

vency of a debtor (507 observations).²⁴ The rarest case of assessment of art collections is the case of inventory of goods brought as a contribution to a marriage by one party or the other (221 observations).

Fig. 7 Distribution of observations over time

The occupation of the owner includes over a hundred different professions in the dataset, which were classified into ten general categories (see Fig. 8). The upper class of the Dutch society was composed by the regents, the large scale merchants and some large manufacturers. The regents were the rulers of the Dutch cities or the heads of charitable organizations (as the orphanages). Large scale merchants were important traders mainly in tobacco, brandy and wine, textile, grain, fish, oil, spices and East Indian products. Between the manufacturers we find producers of boats, leather, dyer, soap, or refiners of salt and sugar, horticulturists, book-printers and beer-brewers; bakers (bread, pastry) and butchers could also fit in this category as small-scale manufacturers in food preparation (Montias, 2002, p. 46). Retail merchants included small-scale distributors of beer and wine, book dealers, apothecaries and small merchants of clothes, faience (porcelain), glassware and ironware. Workers providing services included barbers/surgeons, brokers, innkeepers, notaries, school teachers, auctioneers and tax collectors; services were also provided by workers engaged in liberal professions (doctors in medicine, lawyers, procurers before the court or even preachers). Employees were mainly working for the East or West Indian Company, the Orphan Chamber, banks or insurance chambers, charitable institutions or the city administration. A craftman could be a carpenter, a shoemaker, a tailor, a bookbinder or a framemaker. An artisan could be an armorer, a clockmaker, a diamond polisher, an embroiderer, a lacemaker, a glassmaker, a goldsmith or a jeweler. Finally, artists included musicians, poets, sculptors, map-

²⁴ Remarkably, the Montias dataset contains an important insolvent owner, Rembrandt van Rijn (1656), but since this inventory does not record evaluations it is not present in our dataset.

makers, glass engravers and, of course, painters. We have separated the category of art dealers from the other merchants because of their importance in this market.²⁵

Fig. 8 Distribution of observations by occupation of the owner

Fig. 9 Percentage of observations from different social classes

In the Dutch Republic wealthy citizens as regents, large scale merchants and some of the manufacturers were widely collecting paintings (North, 1999). Remarkably, 43% of the observations for which we know the occupation of the owner are coming from them. However a peculiar characteristic of the Dutch Golden Age was that even the middle class was buying paintings. The

²⁵ Special attention should be paid to art dealers and artists as paintings in their inventories were not only their collections, but part of merchandise.

percentage of observations coming from middle class professions increases over time (see Fig. 9) confirming the gradual development of the art market as a mass market with expanding demand.

The religion of the owner may be related to the demand of art and may have an impact on the composition of paintings in a collection. In our dataset we distinguish three main categories: Catholics (596 observations), Jewish (47 observations) and Protestants (the large majority). In most cases for Protestants it is not known to which exact reformed church the person belonged, so the religion is denoted as Reformed (2326 observations). For the rest of the cases, the exact branch of protestant reformation is specified: Mennonite (98 observations), Lutheran (202), Calvinist (499), Remonstrant (176). Religion could affect the propensity of collectors to hold religious paintings (whose value was generally higher): the iconoclasm of the reformed church (started around 1566) led to destroy and eliminate all the religious paintings from the reformed churches and heavily affected the preferences of the citizens of this religion. As a consequence, this contributed to a drastic reduction in the possession of religious paintings, as can be seen in Fig. 10.²⁶

Fig. 10 Percentage of religious subjects and other figurative subjects among paintings described by subject (5-years moving average)

The subjects of the paintings are classified into the five traditional genres and a residual category: figurative paintings, genre paintings, landscapes, portraits, still-life paintings and unknown genre. To the last group we attribute paintings whose description is absent or unclear. To figurative paintings we attribute religious, mythological, historical paintings and battles following a similar classification already used for instance in Montias (1982). The distribution over time in terms of the number of observations for each genre is shown in Fig 11. We can notice a clear decline in the number of figurative paintings, partially explained, as mentioned before, by a decrease in popularity of religious paintings. Landscapes become the prevailing genre (and between the attributed paintings they have even a bigger share reaching half of the paintings in the collections at the end of the century). This pattern confirms what was found by Montias (1982) in the Delft inventories.

²⁶ See De Vries (1991, p. 265) and Montias (1987, p.459).

Fig. 11 Percentage of each subject among paintings described by subject (5-years moving average)

Fig. 12 Average price of subjects by decades

The pattern of prices adjusted for inflation and divided by genres is reported in Fig. 12. Earlier investigations based on average nominal prices (Chong, 1987; North, 1999) had emphasized a generalized increase in the price of all the genres during the Golden Age, especially in the last quarter of the century and mainly driven by genre and figurative paintings, with a marked increase of the price of portraits during each quarter of the century.²⁷ Looking at the prices adjusted for the inflation rate provides a rather different picture: real prices tend to decrease over the century for all genres, possibly with the exception of portraits and the rather oscillating beha-

²⁷ For instance, Chong (1987) collects data in which the average price of portraits is 5.99 guilders in 1600-25, 10.74 in 1626-50, 23.03 in 1651-75 and 37.05 in 1676-1700. The corresponding figures for genre paintings are 27.79, 22.07, 30.79 and 88.23 guilders respectively, while still life paintings were priced 27.39, 30.13, 23.84 and 41.33 guilders in the four quarters of the century. Without counting the declining prices of architectural subjects, the price of landscapes moves from 30.31 to 21.77, 24.29 and 43.99 guilders. Finally, figurative paintings of religious subject (excluding other histories) move from 33.03, to 43.26, 70.26 and 52.13 guilders.

behavior of the figurative paintings. Moreover, the distribution in terms of prices shows a general tendency toward convergence between prices of different genres during the century, especially through a decline in the price of still life and genre paintings, but also of landscapes.

Our dataset contains about five hundred identified artists: for 70% of them we have more than one observation and more than 60% were born in the XVII century (see Fig. 13).²⁸ Almost 40% of the observations concern works by artists that are still alive: however, the share of paintings that are attributed to living artists falls from 60% in the 1650s to 10% in the 1690s which shows a gradual decline of the demand for the newly produced works (see Fig. 14). The specialization of the Dutch painters in different genres and sometimes sub-genres was impressive. For most of the painters in our dataset we have identified a single genre for their works. Nevertheless, it is normal that some of them were occasionally engaged in different works: for the 330 artists with more than two observations in the dataset (excluding observations of unknown genre) we find that 145 were diversifying their work among at least a couple of genres, 57 between at least three genres, 16 between four genres and only 6 artists have paintings in each genre within our dataset.

Based on the description of the paintings we were able to classify some of them as copies, as large paintings or as small ones. In 43% of the cases for anonymous paintings (and in 17 % of the attributed paintings) the evaluation is given for several paintings together (for example, portraits of godfather and godmother, or allegories of the four seasons). In such cases we divide the price equally between the paintings. We also build a variable which indicates how many paintings were in such a group to test for the existence of quantity discounts.

Fig. 13 Distribution of painters by year of birth

²⁸ Calculations are limited to the painters for whom we were able to find biographical data from art historical sources.

For many paintings in the inventories there was the indication of the room in which the painting was found (two thirds of all the observations in the dataset). Following Loughman and Montias (2002), we group the rooms in 1) private rooms (spaces for the family), 2) public rooms (public spaces used to receive visitors), 3) *voorhuys* (the entrance) and 4) the kitchen. To private rooms we attribute back (*achter-*) rooms, upstairs (*boven-*) rooms, the ‘inner hearth’ (*binnen camer*), sleeping and children rooms. To public rooms we attribute the office (*comptoir*), the main reception rooms such as the great hall (*saaſ*), the great room (*groote camer*) and the best room (*beste camer*). We exclude from the analysis of placement in rooms the front (*voor-*) rooms and side (*zij-*) rooms, because their purpose is not generally clear and can change from family to family, and all the rooms without any indication of their placement within the house. We also build a variable for the number of rooms in the house (as we could count from the placement of objects in the inventory), which can be seen as a proxy of the value of the house and therefore of the wealth of the owner, or at least of the space potentially available for collecting paintings.

To summarize all the variables used in the regression analysis are listed in Tables 1 and 2 together with their main statistics.

Table 1 Summary statistics (Inventories) - continuous variables

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
real price (1597 prices)	17148	9.182	25.520	0.012	1232.596	13.670	403.525
average real price of the rest of the art collection	17122	9.489	13.456	0.082	143.361	3.476	21.267

Table 2 Summary statistics (Inventories) - discrete variables

Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.
Montias dataset	0.434	0.496	City		
			Amsterdam	0.622	0.485
anonymous paintings	0.835	0.371	Haarlem	0.233	0.423
copy	0.036	0.187	Dordrecht	0.072	0.259
large	0.027	0.162	Utrecht	0.072	0.259
small	0.300	0.458			
Nr. of paintings evaluated	3.046	4.194	Owner religion		
			catholic	0.035	0.180
Genre of the Painting			reformed	0.135	0.341
landscape	0.246	0.431	protestant	0.191	0.393
figurative	0.160	0.367	jewish	0.003	0.052
portrait	0.115	0.319	unknown religion	0.771	0.420
still-life	0.087	0.281			
genre	0.065	0.246	Owner occupation		
unknown genre	0.327	0.469	merchant large scale	0.130	0.336
			art dealer	0.039	0.194
Number of rooms	4.983	4.667	merchant retail	0.036	0.186
			services	0.042	0.200
Inventory purpose			craft	0.025	0.155
death	0.341	0.474	artisan	0.025	0.155
insolvency	0.029	0.168	artist	0.018	0.132
collateral	0.014	0.120	manufacturer	0.015	0.112
marriage	0.013	0.112	employee	0.009	0.094
unknown purpose	0.603	0.489	regent	0.006	0.079
			unknown religion	0.656	0.475

Fig. 14 Share of living artists in attributed paintings (5-years moving average)

4. Regressions on Dutch inventories

In this section we report the results of our main econometric investigation in Table 3, where we followed the hedonic regression methodology already applied by Etro and Pagani (2012) to historical art prices. The dependent variable is the logprice of paintings adjusted for CPI, so that the coefficients can be interpreted in terms of semi-elasticities. We present two regressions, the first of which is on the entire dataset available without artist fixed effects, but with a dummy for paintings whose author is anonymous or unidentified in the inventories. The second regression is limited to the attributed paintings and contains fixed effects for each artist with at least two observations (omitting a reference group that contains all the artists with a single observation) and few other characteristics of the painters. The artists' coefficients are separately reported in the Appendix for a selected group of artists with a high enough number of paintings or of significant value. We used the same control variables in both regressions whenever possible, however any comparison between coefficients of the two regressions must be done *cum grano salis*, keeping always in mind that in certain cases an effort to attribute a painting in the inventory was exerted only if the painting (or the entire collection) was valuable enough, therefore the subsample of attributed paintings cannot be regarded as representative of the entire sample. Moreover, the regressions mainly emphasize correlations, without necessarily implying causation.

Let us consider first the macroeconomic variables. The price of paintings is already corrected for changes in the price level during the year of the inventory, therefore the baseline regression emphasizes a negative trend of the real price of paintings during the century. The real wage is positively and significantly related to the price of paintings, which is in line with expectations: years in which the real economy was booming were associated with higher real prices. Of course this could reflect both demand and supply factors, but the relation loses significance after controlling for artist fixed effects, possibly because a painting by a given painter was reflecting more its value as an asset, largely independent from the short run behavior of the economy). Both re-

gressions show that inventories in Amsterdam were on average richer than those in other towns such as Haarlem, Dordrecht and Utrecht: collectors of the main Dutch city had more valuable paintings, and not simply by the most valuable painters since the positive relation holds also in the full specification (even if differentials between towns are smaller).

Once we control for the artists fixed effects and for the year of birth of the same artists, we can provide a more accurate view on the time trend. This remains negative and significant suggesting a robust tendency to a decline in the real price of a representative painting. In spite of this, the relation between the year of birth of painters and the price is U shaped, increasing since the end of the XVI century (the lower point of the parable is in 1575, suggesting that prices started increasing for painters active from the last years of the century). These results appear to support the thesis for which quality increased for the painters of the Golden Age, but painters of a given quality faced decreasing prices, possibly due to strong competition and innovation.

Before moving to analyze the impact of the other characteristics, we have to notice that we cannot control for all of the demand and supply variables, and some collections were simply more valuable because the owners had a higher preference or willingness to pay for art or for more valuable paintings or better painters. To capture these unobservable aspects, we control for the average price of the (other) paintings present within each collection (for this reason we have excluded from the regressions the few inventories with a single painting). As one would expect, the relation is positive and significant (even if of moderate magnitude, suggesting that our control variables account already for a lot of variability in prices) and the coefficient is drastically reduced when we control for the artists fixed effects.

In both the baseline regression and in the one on attributed paintings, price estimates are reduced when more paintings are evaluated jointly (for a sort of quantity discount), when they are copies (because cost and quality tend to be lower) and when they are of a small size.²⁹ The number of rooms in the house could be seen as a proxy of the wealth of the owner or possibly of other characteristics of the collection (average size of paintings, number of paintings) and is positively correlated with prices. As expected, the baseline regression emphasizes drastic price differentials between anonymous paintings and attributed ones: best painters were usually signing their works and owners and evaluators could easily verify their authorship, while minor painters were producing largely undistinguished works of lower value.

One may think that the death of painters could increase the value of their paintings in the secondary market (for a standard story of shock on the supply side), and we have checked for this possibility by verifying whether prices were jumping up in the years after the death of the painters: this does not seem to be the case, probably because of the high substitutability between painters and the still limited importance of the concept of originality in art evaluation.

Price differentials between different genres appear to be extremely wide even when we control for the main features of paintings and owners. We compared the five main genres with the omitted category of paintings whose genre is unknown or not clearly identified in the title recorded in the inventory. Our baseline regression shows that figurative paintings were evaluated 79% more than the reference group, landscape and genre paintings 67% more, still life paintings 58% more

²⁹ It is important to remark that we do not have precise data on the size of paintings, and we could only classify them as small or large compared to the average size (when the description of the painting mentioned that), however the variability in size was lower in home collections compared to paintings destined to public commissions (which could be much larger).

and the portraits were evaluated 35% more than the omitted group.³⁰ These differences almost disappear when we control for the unobservable characteristics of the painters, with only the figurative paintings that are still evaluated 12% more than the reference group, landscapes, still life and genre paintings that are not significantly different, and portraits that are evaluated 19% less. This could suggest that, after taking into account quantitative aspects of the paintings and unobservable quality of the painters, most of the price differentials between genres were negligible. This is in line with what found in the contemporary primary market for paintings in Rome by Etro *et al.* (2011). Here, however, we are looking at a secondary market, where price differentials between genres due to changes in preferences could persist even if they were absent in the primary market: more precisely, price differentials in the secondary market could induce adjustments in the production of different genres in the primary market, but this would lead to price convergence only gradually in the secondary market.

Some of the features characterizing the owners are clearly related to their income, and possibly to their willingness to pay for more valuable artworks, and therefore to the value of the paintings they bought in life. However, once we control for the intrinsic quality of the paintings, namely considering the unobservable quality of different painters, we expect that most of the differences should disappear: there is a reason why a rich regent could and should have more valuable paintings, but no reason why a Vermeer owned by a regent should be more valuable than another Vermeer of the same size and genre owned by a baker. We have controlled for job and religion of the owners. The main result is that in the baseline regression most dummies are significant, but most of these correlations disappear when we control for the artist fixed effects. Looking at the religion of the owner after controlling for artists effects, there are no significant differences.

Another interesting piece of evidence is about the purpose of the inventory. Again, this may be correlated with prices but the evaluation of paintings of a given quality should not be largely affected by the purpose of the same evaluation. Indeed, in the baseline regression we find higher prices in inventories prepared for a marriage and to prepare a collateral for the creditors. This may reflect positive selection effects: owners selected better paintings for these purposes or decided to organize inventories when they had paintings by better artists to use for these purposes. To the contrary, prices appear lower in inventories due to the insolvency of the owner or after the death of the owner. This may reflect negative selection effects: debtors and heirs were forced to record all paintings including those by worse painters. Remarkably, none of these correlations appear to be robust after controlling for the artists' features. This is what we would expect in a competitive market: the purpose of the inventory could not affect the evaluation of a given painting by a given artist.³¹

In conclusion, we report in Table A.1 of the Appendix the artists fixed effects for selected painters with enough observations or in any case with significant coefficients. The omitted category is the group of over a hundred artists with a single observation, including old masters as Jan van Eyck, Hieronymus Bosch, Jan Gossaert (Mabuse) and modern ones as Karel Dujardin, Adam

³⁰ One should notice that portraits were penalized in the evaluation of the secondary market since the value for the commissioner was higher than the value for another collector.

³¹ In unreported regressions we also included the position of the painting in the home of the owner: this is quite informative on its value, but can be seen as a consequence of the characteristics of the painting, not a determinant of supply or demand conditions. Omitting paintings in generic or unknown rooms, we found that paintings that were placed in the main entrance of the house or in general in public rooms were more valuable, while paintings located in the kitchen or in other private rooms were less valuable (as in Loughman and Montias, 2001). However, when we control for the artists fixed effects, only one result is robust: private rooms contained paintings of lower value. Leaving further analysis of the allocation of paintings in the Dutch houses to later discussion, this suggests that public rooms simply contained paintings by better artists.

Elsheimer, Willem van Aelst, Joannes Vermeer and many others. The ranking is largely in line with what we know about the consideration of painters at the time. The best figurative painters include contemporary Dutch painters as Rembrandt van Rijn and Pieter Lastman, famous contemporary Flemish painters such as Jacob Jordaens and Pieter Paul Rubens, mannerists such as Joachim Wtewael and Bartholomeus Spranger and old masters such as Geertgen Tot Sint Jans and Lucas van Leyden. The best landscapists include Paul Bril, Jan Asselyn, Claes Berchem, David Teniers, Emanuel de Witte, Johannes Lingelbach, Jacob Ruisdael and Jan Brueghel. It is remarkable that famous landscape painters that adopted the cost saving innovation of the monochromatic style such as Esaias van de Velde, Jan van Goyen, Salomon van Ruysdael and Pieter de Molijn do not have an evaluation that is significantly higher than average. Top genre painters included Gabriel Metsu, Gerard Ter Borch, Gerrit van Honthorst and Hendrick ter Brugghen, while the best paid still lifes were by Jan de Heem, Joachim Beuckelaer and Frans Snyders. Distinguished portraitists include the German master Hans Holbein, the Dutch master Paulus Moreelse and the Flemish master Antoine van Dyck (see Plate 3).

Plate 3: Van Dyck, Anthoine, Portrait of Willem II of Nassau-Orange and princess Maria, 1641, Amsterdam, Rijksmuseum

Table 3 Price equation for Inventories

Variables	Baseline OLS			OLS on attributed paintings with artists FEs		
	Coef.		t-statistics	Coef.		t-statistics
Year	-0.008	***	(-14.36)	-0.012	***	(-4.73)
Real wage	0.006	***	(4.15)	0.005		(1.35)
City						
Amsterdam	omitted			omitted		
Dordrecht	-0.443	***	(-12.92)	-0.226	*	(-1.69)
Haarlem	-0.491	***	(-18.26)	-0.333	***	(-4.15)
Utrecht	-0.626	***	(-17.34)	-0.541	***	(-5.49)
Av. Price rest of the collection	0.033	***	(40.54)	0.017	***	(14.08)
Number of rooms	0.014	***	(7.57)	0.013	***	(3.21)
Nr. of paintings evaluated	-0.043	***	(-20.22)	-0.174	***	(-6.29)
Copy	-0.627	***	(-14.82)	-0.961	***	(-12.77)
Large Size	0.946	***	(19.64)	0.728	***	(8.13)
Small Size	-0.466	***	(-26.31)	-0.514	***	(-12.54)
Anonymous	-1.186	***	(-51.80)	-		
Years after death				-0.001		(-0.36)
Birth date				-0.126	*	(-1.82)
Birth date squared				0.00004	*	(1.83)
Genre of the Painting						
unknown genre	omitted			omitted		
landscape	0.672	***	(28.19)	-0.024		(-0.38)
figurative	0.785	***	(28.94)	0.119	*	(1.68)
portrait	0.348	***	(12.21)	-0.186	**	(-2.12)
still-life	0.582	***	(18.33)	0.136		(1.50)
genre	0.676	***	(18.97)	0.03		(0.38)
Owner religion						
unknown religion	omitted			omitted		
catholic	-0.204	***	(-4.40)	0.166		(1.51)
protestant	-0.096	***	(-3.55)	0.05		(0.80)
jewish	-0.294	*	(-1.86)	-		
Owner occupation						
unknown occupation	omitted			omitted		
merchant large scale	0.115	***	(3.44)	-0.044		(-0.55)
art dealer	-0.095	*	(-1.67)	-0.09		(-0.86)
merchant retail	-0.380	***	(-7.88)	-0.632	***	(-5.08)
services	-0.016		(-0.35)	-0.233	*	(-1.78)
craft	-0.450	***	(-7.99)	-0.222	*	(-1.93)
artisan	-0.294	***	(-5.35)	-0.265	***	(-2.59)
artist	0.122	*	(1.86)	-0.184		(-1.19)
manufacturer	0.041		(0.58)	-0.054		(-0.35)
employee	0.148	*	(1.75)	-0.148		(-0.86)
regent	0.485	***	(4.74)	0.027		(0.14)
Inventory purpose						
unknown purpose	omitted			omitted		
death	-0.222	***	(-7.01)	0.057		(0.87)
insolvency	-0.263	***	(-4.91)	-0.133		(-1.01)
collateral	0.264	***	(3.69)	-0.066		(-0.51)
marriage	0.274	***	(3.49)	0.177		(0.95)
<i>Constant</i>	14.569	***	(15.77)	121.973	**	(2.28)
<i>Observations</i>	17122			2700		
<i>Adjusted R2</i>	0.56			0.63		

5. Placement of paintings in Dutch houses: a multinomial Probit model

In this section we search for patterns in the placement of paintings within Dutch houses of the XVII century. We are interested in how paintings were distributed throughout the houses in terms of their prices, dimensions and genres. By running a multinomial Probit model on painting characteristics we identify where the painting was most likely to be placed. We find that the most

expensive paintings were mainly placed in the reception areas, and the largest paintings at the entrance, the *voorhuys*. Moreover, certain genres were regarded as more appropriate in specific rooms: for instance, mythological subjects were likely to be met in the private rooms of the house³² while landscapes were the most likely subject of the entrance. Finally, it was not likely to find portraits or paintings of a religious subject at the entrance of the house,³³ and still-life paintings were more likely to be displayed in the kitchens.

We are not the first to investigate this issue. Loughman and Montias (2001) have studied the distribution of paintings and other works of art in the rooms by number and by subject looking at inventories in Amsterdam (partly the same used here). They made a complete classification of rooms that were frequently met in the inventory records and identified rooms where paintings were overrepresented. They used a Chi-square test to compare distributions of paintings in different rooms. One of their strong conclusions was that paintings of large size, attributed to artists and described by subject in the inventory (there were many cases in which the painting subject was not specified in the inventory records, a sign of minor importance) were more frequent in public spaces. They also found that the specialization of rooms by subject was relatively weak, but they could not control for a number of factors in their descriptive analysis. Our methodology differs because we limit our investigation to priced paintings and our dataset is partly different.

Fig. 15 Shares of paintings displayed in different spaces by decades

A preliminary look at the data allows us to appreciate the general tendencies in displaying pictures in the Dutch houses. First of all, notice that 45% of our observations come from private rooms (3213 observations), 30% from the *voorhuys* (2145), 15% from other public rooms (115) and 10% from the kitchen (720 observations). In terms of prices, public spaces and the *voorhuys* contained more expensive works and this pattern is constant over time (see Fig. 16). In terms of genres, there is an increasing pattern of placing portraits in private rooms (see Fig. 17). Landscapes are the prevailing and increasing genre in all the rooms. The share of landscapes among possible genres is the largest in the *voorhuys*.

³² This point is robust to different time spans.

³³ This point is robust to different time spans.

Fig. 16 Average price of paintings in different spaces (10-years moving average)

Fig. 17 Distribution of portraits among rooms by decade

We run a multinomial Probit model on painting characteristics, that is price, dimensions (large, small) and genres, including some sub-genres (landscapes, portraits, still-lives, genre paintings and figurative ones divided in mythological subjects, battles, sacred subjects and historical ones)³⁴ to identify where a painting was most likely to be placed.

³⁴ Notice that the dataset is restricted to paintings described by genre.

The results are presented in Table 4. The price has the most relevant impact on the placement: when it increases of one guilder from its mean value of 15 guilders, the probability that a painting is placed in a public space is expected to increase by 0.2%; the probability of being placed in the *voorhuys* is expected to increase by 0.1% and the probability of being placed in private rooms is expected to decrease by 0.2%. The marginal impact of size is positive and significant for the *voorhuys* relative to the private rooms and the kitchen: larger paintings were more likely to be in the entrance and less likely to be in private spaces.

Table 4 Multinomial probit model for the placement of paintings

Regression coefficients when base outcome is private space

	Public rooms		Voorhuys		Kitchen	
	coef	z	coef	z	coef	z
Price	0.011 ***	(9.37)	0.006 ***	(5.01)	0.003	(1.34)
Copy	0.278	(1.44)	0.241	(1.34)	0.066	(0.24)
Attributed	-0.012	(-0.14)	-0.114	(-1.39)	-0.112	(-0.89)
Painting size						
<i>unknown</i>	<i>omitted</i>					
large	0.089	(0.54)	0.483 ***	(3.25)	-0.196	(-0.71)
small	0.004	(0.06)	0.065	(1.01)	0.132	(1.42)
Painting subject						
<i>landscape</i>	<i>omitted</i>					
portrait	-0.079	(-0.90)	-0.519 ***	(-6.28)	-0.532 ***	(-4.08)
still life	-0.010	(-0.10)	-0.064	(-0.72)	0.206 *	(1.70)
genre	0.034	(0.30)	-0.160	(-1.53)	-0.312 *	(-1.86)
myth	-0.321 **	(-2.46)	-0.590 ***	(-4.86)	-0.334 *	(-1.89)
battle	0.244	(0.84)	-0.005	(-0.02)	0.146	(0.38)
sacre	0.076	(0.83)	-0.229 ***	(-2.70)	-0.119	(-0.95)
history	0.318	(1.31)	-0.275	(-1.13)	-0.108	(-0.30)
<i>Constant</i>	-0.818 ***	(-13.90)	-0.229 ***	(-4.34)	-1.404 ***	(-17.89)
<i>Observations</i>	4762					
<i>Log likelihood</i>	-5549					
<i>LR chi2(36)</i>	229					
<i>Pseudo R2</i>	0.022					

* $z < 0.10$, ** $z < 0.05$, *** $z < 0.01$ base outcome (private space)

Marginal effects at the mean

	Private rooms		Public rooms		Voorhuys		Kitchen	
	dy/dx	z	dy/dx	z	dy/dx	z	dy/dx	z
Price	-0.002 ***	(-6.9)	0.002 ***	(9.26)	0.001 **	(2.47)	-0.0002	(-0.91)
Copy	-0.072	(-1.56)	0.039	(0.96)	0.040	(0.88)	-0.007	(-0.35)
Attributed	0.024	(1.09)	0.009	(0.54)	-0.027	(-1.4)	-0.006	(-0.63)
Painting size								
<i>unknown</i>	<i>omitted</i>							
large	-0.089 **	(-2.29)	-0.024	(-0.82)	0.139 ***	(3.54)	-0.026 **	(-2.01)
small	-0.016	(-0.94)	-0.007	(-0.54)	0.014	(0.87)	0.010	(1.22)
Painting subject								
<i>landscape</i>	<i>omitted</i>							
portrait	0.108 ***	(5)	0.034 *	(1.85)	-0.116 ***	(-6.55)	-0.025 ***	(-3.42)
still life	0.003	(0.12)	-0.001	(-0.07)	-0.023	(-1.08)	0.022 *	(1.85)
genre	0.032	(1.13)	0.027	(1.16)	-0.039	(-1.59)	-0.019 **	(-2)
myth	0.143 ***	(4.59)	-0.019	(-0.77)	-0.118 ***	(-4.77)	-0.007	(-0.53)
battle	-0.034	(-0.46)	0.054	(0.86)	-0.028	(-0.43)	0.008	(0.23)
sacre	0.031	(1.38)	0.039 **	(2.05)	-0.065 ***	(-3.34)	-0.005	(-0.58)
history	0.001	(0.01)	0.105 *	(1.81)	-0.096 *	(-1.93)	-0.009	(-0.37)

* $z < 0.10$, ** $z < 0.05$, *** $z < 0.01$ for dummy variable it is marginal effect of discrete change from 0 to 1

Also the genre of paintings appears to be an important factor for the placement of paintings in the Dutch houses of the XVII century. Portraits are unlikely to be in the entrance and likely to be in a private room. A still life painting is more likely to be placed in the kitchen relative to a

landscape, which is not surprising given that many still life paintings were representing kitchens (see Plate 4). The typical genre of the entrance is the landscape, since any other genre is less likely to be placed there. Genre paintings are spread in all rooms, except for being less likely in the kitchen of a Dutch house of the XVII century. Concerning figurative paintings, their placement depends on their subject: mythological paintings are more often in the private rooms, while religious and historical subjects are more likely to be in the public rooms. All this suggests that Dutch collectors were careful and somewhat systematic in placing their paintings (as other decorative elements) in their houses.

Plate 4: Snyder, Frans, *Poultry*, 1620 ca, Brussels, Musees Royaux des Beaux-Arts

5. A look at art auctions in Amsterdam

The second investigation we propose to confirm our results is about art auctions taking place in Amsterdam always during the XVII century. To build the dataset on auctions we rely on two main sources: data on the Amsterdam auctions of the Orphan Chambers of the period 1597-1638 collected by John Montias and now maintained at the Frick Collection research center (hereafter the Montias dataset)³⁵ and other auctions held in Amsterdam in the period 1676-1699 administrated by the Getty research institute (hereafter Getty sales dataset).³⁶

In these auctions all lots sold belonged to a unique owner (usually a dead person, as for the death inventories; see Montias, 2002), therefore the data contain information that was similar to that of the inventories studied above. We do not have additional information on the (apparently rare) unsold items. This is probably due to the fact that these were probably descending price auctions (what today we call “Dutch auctions”) and all lots were sold at a low enough price.

³⁵ Available from the website <http://research.frick.org/montias/home.php>

³⁶ Available from the website <http://piprod.getty.edu/starweb/pi/servlet.starweb>. This dataset contains also few auctions from Rotterdam and The Hague, but we eliminated them for consistency with the Montias dataset on Amsterdam.

The information available from the Montias dataset contains the following details: date of the auction, city, name of the notary, total value of the objects sold, total value of the art objects sold, number of items that were sold. The information available on the owner of the art collection at sale includes his or her name with biographical details, occupation, religious views and place of residence. Each record of paintings in the auction dataset has the same information as in the inventories dataset from Montias, plus information on the buyer of the paintings: his name, religion, profession and whether he had relative ties with the seller. The Getty dataset contains less information: we are only aware of the auction date, the city and name of the seller. We do not have personal details on sellers and buyers of the art collections. The information concerning the paintings and their subject and basic characteristics, however, is the same as in the Montias dataset, and we used the Dutch description of the painting to build the same dummies used for the analysis of the inventories. All variables are listed in the Tables 5 and 6.

In the rest of the section we will comment the results of our main regressions in Table 7 and compare them with those from the inventories. The dependent variable is always the logprice of paintings adjusted for CPI. We present again two regressions, the first on the entire dataset available without artist fixed effects and the second one limited to the attributed paintings with fixed effects for each artist, whose coefficients are separately reported in the Appendix, as before for a selected group of artists. We used the same control variables as in the regressions for the inventories whenever possible.

Let us consider first the macroeconomic variables. The real wage shows a positive and significant impact on prices, as it was for the inventories, but only in the baseline regression. When controlling for the author, the price appears to be independent from short run fluctuations of the real economy, as if what matters is the long run value of the painting, exactly what we expect from the equilibrium pricing of an asset (with an aesthetic dividend). As for the inventories, the time trend is negative, and the year of birth follows a U shaped pattern with the increasing part starting at the end of the XVI century (the lower point of the parable occurs for artists born in 1567, which suggests increasing prices starting in the last decade of the century). Again, this is consistent with the idea that quality as priced by the market did increase for the painters of the Golden Age, but a painter of given quality would face decreasing prices during the XVII century due to strong competition and innovation.

We confirm exactly the same positive impact of the average value of the collection (now sold at auction) that we found in the inventories: we interpret this as evidence that there are residual unobservable characteristic of the painting correlated with the owner of the collection, and some of them are controlled by the artists unobservable characteristics captured by the fixed effects. Objective variables of the sales have the same impact found for the inventories. When multiple paintings are sold in a single lot, their price decreases, which here represents a sort of direct quantity discount. Copies are paid less than originals and size affects prices in a similar way as in the inventories. Price differentials between attributed and anonymous paintings are almost identical between auctions and inventories.

Also the price differentials between genres replicate what we found before. In the full dataset, figurative paintings are still the best paid, with 107% higher prices compared to the omitted category, which comprises unidentified and unknown genres. Again, genre paintings are the second best group, with prices that are 98% higher, and still life and landscape paintings follow with respectively 96% and 95% higher prices than the reference category. Portraits are priced only 9%

more than the other paintings of unknown subject. Most of these differences disappear when we control for the artists fixed effects: genre paintings, still lifes and portraits are not significantly different from the reference category, while figurative paintings have a premium reduced to 38% and landscapes have a premium of 22% relative to the omitted group.

Table 5 Summary statistics (Auctions) - continuous variables

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
real price (1597 prices)	10266	10.667	26.243	0.034	846.068	9.625	175.963
average real price of the rest of the art collection	10241	10.558	12.749	0.128	79.910	2.481	11.153

Table 6 Summary statistics (Auctions) - discrete variables

Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.
Montias dataset	0.926	0.261	Genre of the Painting		
			landscape	0.146	0.354
Nr. of paintings jointly sold	2.100	2.582	figurative	0.241	0.428
copy	0.004	0.065	portrait	0.083	0.275
large	0.017	0.128	still-life	0.056	0.229
small	0.163	0.369	genre	0.046	0.208
anonymous paintings	0.898	0.303	unknown genre	0.428	0.495
Owner occupation			Buyer occupation		
merchant large scale	0.097	0.297	merchant large scale	0.104	0.306
art dealer	0.047	0.213	art dealer	0.164	0.370
services	0.063	0.243	services	0.024	0.153
craft	0.022	0.148	craft	0.018	0.131
artisan	0.036	0.187	artisan	0.026	0.160
artist	0.211	0.409	artist	0.065	0.246
manufacturer	0.030	0.171	manufacturer	0.027	0.163
employee	0.026	0.159	employee	0.022	0.147
merchant retail	0.028	0.165	merchant retail	0.016	0.125
regent	0.002	0.046	regent	0.005	0.074
unknown	0.434	0.496	unknown	0.529	0.499
Owner religion			Buyer religion		
catholic	0.068	0.252	catholic	0.020	0.141
protestant	0.101	0.302	protestant	0.054	0.227
unknown	0.831	0.375	jewish	0.004	0.065
Buyer is relative of seller	0.078	0.269	unknown	0.921	0.270

As for the inventories, information on the job and religion of the owners can be useful, but here we also have the same information concerning the buyers. As before, the characteristics of the owner have a certain explanatory power in the baseline model, but after controlling for the unobservable features of the paintings through the artists fixed effects, few relations are robust. The price premium for the Protestant may reflect the fact that, since iconoclasm within reformed churches, the Catholics did not find in the auction market a valuable market to sell their precious religious paintings.

Looking at the buyers, we find that merchants and manufacturers together with employees appear to pay higher prices, also after controlling for the artists effects, while other jobs or religions do not show relevant or significant correlations with prices as long as the focus is on paint-

ings for which we can control for the artist quality. Overall, these results appear in line with what the economic theory would suggest: competitive markets as those emerging in these auctions did price paintings in a way that was largely independent from the particular features of buyers. A last interesting aspect concerns the (non-infrequent) cases in which the buyer was related to the seller (as identified by John Montias): some evidence of higher prices for these cases emerges in the baseline regression but disappears in the full specification: when relatives paid more, it was just because the painting was by a higher-quality artist.

Plate 5: Droochsloot, Joost Cornelisz, *Landscape with village scene*, 1623, Etro collection

In conclusion, we report in Table A.2 of the Appendix the artists fixed effects for selected painters with enough observations or in any case with significant coefficients. The omitted category contains a hundred painters with a single observation, including also famous names such as old masters like Joos van Cleve, Joachim Beuckelaer and modern ones like Frans Hals, Joachim Wtewael, Hercules Seghers, Paulus Moreelse, Ferdinand Bol and many others. Again the ranking is largely in line with what we know about the consideration of painters at the time and, of course, with what found in the inventories, but the availability of late auctions in the century allow us to find more frequently important names from the second half of the century. Top genre painters reveal now new names such as Johannes Vermeer and Jan Steen and others already found in the top positions within inventories, such as Gerard Dou, Gabriel Metsu, Gerard Ter Borch and Gerrit van Honthorst. The best figurative painters include as before Lucas van Leyden, Jacob Jordaens, Pieter Paul Rubens and Pieter Lastman plus new names like Gerard de Lairesse. The best landscapists include again Jan Asselyn, Claes Berchem, David Teniers, Emanuel de Witte, Johannes Lingelbach, Adriaen van de Velde and Jan Brueghel plus new names such as

Pieter Brueghel, Sebastian Vrancx, Adriaen van Ostade, Philips Wouverman and Joost Droochsloot (see Plate 5). Remarkably, none of the famous landscape painters (present in the dataset) that adopted the fast monochromatic style, such as Jan van Goyen or Jan Porcellis have prices that are significantly higher than average, and the most extreme in depicting small monochromatic scenes, Jan van Goyen, appears to be evaluated much less than the others.³⁷ Finally, the best paid still lifes were by Jan de Heem, Melchior Hondecoter, Willem van Aelst and Jan Weenix.

Our data do not provide any way to identify the exact paintings present in inventories and auctions, therefore we are unable to find out repeated sales or evaluations of the same paintings over time, which would be useful to estimate a return of the investment in art and to draw systematic inferences on the price of paintings made by the artists in different stages of their careers. Nevertheless, there is a unique case in which we can safely identify a number of paintings by the same artists: these are twenty paintings by the celebrated Delft painter Johannes Vermeer (see Plate 6) and identified in Montias (1989), mostly through their description in an auction taking place in Amsterdam on 1696. Since we know the price at which these paintings were sold, we have a rather precise idea (from art historical research) of the year in which Vermeer painted them, and we know their exact size, this is virtually the only case in which we can test the Galenson hypothesis on the lifecycle of a Dutch painter on the basis of historical prices.³⁸ Galenson (2007) has classified Vermeer as a conceptual innovator, in the sense that his contribution was not the fruit of lifelong experimentations (as for Rembrandt), but was just a different way of approaching painting which emerged from the beginning: the implication would be that his quality, as priced by the market, should have reached its peak at an early age. In Fig. 18 we plot the price per square meter of his paintings in relation with the age of execution. While only suggestive, the pattern seems to support the Galenson hypothesis: the trend appears increasing only initially in the young age (with a peak around the age of 30 in a regression with a quadratic term).

Fig. 18 Age-Price profile for a conceptual innovator

³⁷ On the other side, we should mention that in the second part of the century, few painters from Leiden known as *Fijnschilders* (literally “fine-painters”), adopted a different and time-consuming style with meticulously executed small-scale works, and some of them as Gerard Dou and Willem van Mieris appear to be the best paid in auctions.

³⁸ For a similar investigation on Italian Baroque painters see Etro and Pagani (2012).

Table 7 Price equation for Auctions

Variables	Baseline OLS			OLS on attributed paintings with artists FEs		
	Coef.		t-statistics	Coef.		t-statistics
Year	-0.006	***	(-7.40)	-0.010	***	(-3.10)
Real wage	0.014	***	(5.74)	0.0001		(0.02)
Av.Price rest of collection	0.054	***	(46.10)	0.018	***	(10.18)
Nr. of paintings jointly sold	-0.135	***	(-30.02)	-0.230	***	(-4.50)
Copy	-0.423	**	(-2.41)	-0.998	***	(-6.45)
Large Size	0.814	***	(9.11)	0.733	***	(6.17)
Small Size	-0.163	***	(-4.75)	-0.625	***	(-7.22)
Anonymous	-0.937	***	(-17.12)	-		
Genre of the Painting						
unknown genre	omitted			omitted		
landscape	0.948	***	(26.34)	0.224	**	(2.18)
figurative	1.069	***	(36.43)	0.380	***	(3.79)
portrait	0.094	**	(1.99)	0.058		(0.33)
still life	0.966	***	(18.71)	0.237		(1.31)
genre	0.983	***	(17.03)	0.243		(1.63)
Seller religion						
religion unknown	omitted			omitted		
catholic	0.330	***	(6.60)	0.226		(1.20)
protestant	0.379	***	(9.78)	0.391	**	(2.28)
Seller occupation						
unknown occupation	omitted			omitted		
merchant large scale	-0.141	***	(-3.46)	0.452	**	(2.35)
artdealer	0.208	***	(3.69)	-0.136		(-0.35)
services	-0.141	***	(-2.89)	0.088		(0.25)
craft	-0.433	***	(-5.59)	-		
artisan	0.048		(0.71)	0.989	***	(3.20)
artist	-0.105	***	(-3.22)	-0.238		(-1.39)
manufacturer	-0.017		(-0.26)	0.617		(0.91)
employee	-0.204	***	(-2.83)	-0.021		(-0.03)
merchant retail	-0.167	**	(-2.40)	-0.031		(-0.05)
regent	-0.141		(-0.58)	-0.572		(-0.94)
Buyer religion						
unknown religion	omitted			omitted		
catholic	0.175	**	(2.18)	0.186		(0.64)
protestant	0.247	***	(4.69)	0.029		(0.17)
jewish	0.513	***	(2.87)			
Buyer occupation						
unknown occupation	omitted			omitted		
merchant large scale	0.775	***	(18.96)	0.510	***	(4.08)
artdealer	0.021		(0.63)	-0.001		(-0.00)
services	0.341	***	(4.58)	0.407		(1.40)
craft	0.239	***	(2.78)	-		
artisan	0.457	***	(6.36)	0.396		(1.57)
artist	0.114	**	(2.38)	0.134		(0.79)
manufacturer	0.523	***	(7.50)	0.412	*	(1.80)
employee	0.417	***	(5.39)	0.736	***	(3.03)
merchant retail	0.388	***	(4.25)	0.606	*	(1.65)
regent	0.617	***	(3.98)	0.402		(0.71)
Buyer is relative of the seller	0.271	***	(6.32)	0.138		(0.66)
Birth date				-0.293	***	(-2.64)
Birth date squared				0.0001	***	(2.69)
<i>Constant</i>	10.306	***	(7.06)	242.908	***	(2.77)
<i>Observations</i>	10241			1029		
<i>Adjusted R2</i>	0.54			0.54		

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Plate 6: Vermeer, Johannes, *The Astronomer*, 1668, Paris, Louvre Museum

5. Conclusion

We have explored the secondary market for paintings of Dutch and Flemish artists during the Golden Age of the XVII century with an econometric analysis of data drawn from inventories and auctions. Further work could adopt instrumental variable analysis to clarify the causal relation between demand and supply features and equilibrium prices and entry of painters, or it could test economic theories of asset pricing in a secondary market from a finance perspective. After all, paintings were a widespread and rather liquid asset (with an esthetic dividend) and the development of financial investments in the XVII century Netherlands was impressive. As the contemporary English writer John Evelyn wrote in 1641, it was because of the absence of land to invest in, that the Dutch middle class invested not only in stocks of the East Indian Company and tulips' bulbs, but also in paintings.

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Appendix

Table A.1 – Artists Fixed Effects in Inventories (with number of paintings)

Artist	Coef	t-st	obs	Artist	Coef	t-st	obs
Bril, Paul	1.736 ***	(4.56)	5	Mostaert, Gillis	0.255	(0.76)	7
Beuckelaer, Joachim	1.697 ***	(3.45)	3	Seghers, Hercules	0.25	(1.45)	38
Heem, Jan Davidsz. De	1.669 ***	(4.56)	5	Ruysdael, Salomon Van	0.227	(0.72)	7
Jordaens, Jacob	1.585 ***	(5)	7	Heemskerck, Maerten Van	0.227	(0.64)	7
Metsu, Gabriel	1.580 ***	(3.38)	3	Goor, Steven Jansz. Van	0.216	(0.96)	15
Duck, Jacob A.	1.281 ***	(2.73)	3	Zeeman, Reinier	0.211	(0.85)	12
Geertgen Tot Sint Jans	1.256 **	(2.38)	3	Keirincx, Alexander	0.2	(0.69)	8
Holbein, Hans (II)	1.233 ***	(3.26)	6	Pynas, Jan Symonsz.	0.195	(0.81)	13
Koninck, Salomon De	1.214 ***	(4.96)	13	Willaerts, Adam	0.195	(0.67)	9
Moreelse, Paulus	1.176 ***	(3.16)	5	Hondecoeter, Gillis De	0.193	(1.08)	31
Fyt, Jan	1.174 ***	(3.21)	5	Everdingen, Allart Van	0.185	(1.13)	34
Leyden, Lucas Van	1.162 ***	(3.05)	6	Nieulandt, Adriaen Van	0.167	(0.53)	7
Rubens, Pieter Paul	1.148 ***	(4.4)	11	Ostade, Adriaen Van	0.118	(0.47)	13
Balen, Hendrick Van (I)	1.146 ***	(3.08)	5	Koninck, Philips De	0.118	(0.45)	10
Snyders, Frans	1.110 ***	(2.94)	5	Martsen, Jan, De Jonge	0.076	(0.26)	8
Borch, Gerard Ter (II)	1.106 ***	(3.05)	5	Jansz., Govert (Mijnheer)	0.043	(0.22)	26
Ochtervelt, Jacob	1.104 ***	(2.68)	4	Moucheron, Frederick De	0.039	(0.12)	7
Honthorst, Gerrit Van	1.092 ***	(2.68)	4	Molenaer, Claes	0.031	(0.11)	9
Marseus Schriek, Otto	1.061 ***	(3.97)	10	Rijckhals, Francois	0.006	(0.02)	9
Backhuysen, Ludolf	1.048 ***	(2.86)	5	Scorel, Jan Van	-0.038	(-0.12)	9
Bleker, Dirck	1.045 ***	(2.85)	5	Codde, Pieter Jacobs	-0.047	(-0.18)	11
Spranger, Bartholomeus	1.009 **	(2.11)	4	Wyck, Thomas	-0.071	(-0.29)	12
Hackaert, Jan	0.954 **	(2.36)	4	Hals, Frans	-0.078	(-0.31)	13
Lastman, Pieter	0.947 ***	(3.36)	9	Goyen, Jan Josephsz. Van	-0.084	(-0.63)	69
Stoop, Maerten	0.946 **	(2.02)	3	Barendsz., Dirck	-0.086	(-0.26)	7
Rembrandt Van Rijn	0.907 ***	(5.96)	40	Vroom, Hendrick	-0.113	(-0.50)	20
Wtewael, Joachim	0.906 ***	(5.12)	53	Lundens, Gerrit	-0.116	(-0.39)	8
Bosch, Pieter Van Den	0.889 **	(2.18)	4	Pynas, Jacob Symonsz.	-0.151	(-0.61)	12
Holsteijn, Cornelis	0.883 *	(1.91)	3	Molenaer, Jan Miense	-0.164	(-1.30)	78
Teniers, David (II)	0.876 ***	(3.32)	11	Bramer, Leonard	-0.206	(-0.80)	11
Asselyn, Jan	0.871 **	(2.41)	5	Molijn, Pieter De	-0.211	(-1.36)	40
Huchtenburgh, Jan Van	0.841 **	(2)	4	Victors, Jan	-0.215	(-0.69)	7

Artist	Coef	t-st	obs	Artist	Coef	t-st	obs
Pynacker, Adam	0.828 ***	(2.67)	7	Peeters, Bonaventura	-0.223	(-1.01)	17
Vertangen, Daniel	0.789 ***	(4.33)	30	Velde, Esaias Van De	-0.233	(-1.02)	16
Floris, Frans (I)	0.787 ***	(2.73)	11	Hondecoeter, Melchior De	-0.266	(-0.92)	9
Dou, Gerard	0.783 **	(2.14)	5	Schellinks, Willem	-0.299	(-0.96)	7
Jansz., Stoffel	0.781 *	(1.8)	4	Koets, Roelof	-0.301	(-1.25)	13
Brugghen, Hendrick Ter	0.767 **	(2.09)	5	Brouwer, Adriaen	-0.325	(-1.33)	13
Dyck, Anthonie Van	0.762 **	(2.26)	6	Diepraem, Abraham	-0.345	(-1.10)	8
Goltzius, Hendrick	0.733 **	(2.39)	8	Troyen, Rombout Van	-0.364 **	(-2.18)	33
Cornelisz. Van Haarlem	0.723 ***	(3.67)	29	Quast, Pieter Jansz.	-0.377	(-1.54)	12
Bruegel, Jan (I)	0.719 ***	(2.59)	10	Susenier, Abraham	-0.383	(-1.54)	15
Key, Willem	0.707 **	(2.56)	14	Hals, Dirck	-0.404 *	(-1.73)	15
Berchem, Claes Pietersz.	0.704 **	(2.28)	7	Momper, Joos De	-0.420 **	(-2.34)	38
Backer, Jacob Adriaensz.	0.692 **	(2.08)	6	Fris, Pieter	-0.449	(-1.10)	4
Francken, Frans (II)	0.680 **	(2.11)	7	Mander, Karel Van (I)	-0.451 **	(-1.96)	18
Both, Andries Dircksz.	0.672 *	(1.66)	4	Blocklandt, Anthonie	-0.458	(-1.36)	7
Bout, Peeter	0.65	(1.41)	4	Engels, Bartholomeus	-0.476	(-0.98)	3
Vries, Hans Vredeman De	0.644	(1.63)	5	Ormea, Willem	-0.477	(-1.02)	3
Witte, Emanuel De	0.642 ***	(2.62)	12	Leeuw, Pieter Van Der	-0.5	(-1.02)	3
Lingelbach, Johannes	0.625 ***	(2.89)	16	Buesem, Jan Jansz.	-0.513 *	(-1.93)	11
Both, Jan	0.618 **	(2.22)	9	Beyeren, Abraham Van	-0.527	(-1.44)	5
Fabritius	0.618 *	(1.95)	7	Claesz., Pieter	-0.533 ***	(-3.49)	63
Vrancx, Sebastian	0.617 **	(2.22)	10	Weenix, Jan, De Jonge	-0.544 **	(-2.54)	27
Cuyp, Benjamin Gerritsz.	0.599 *	(1.81)	7	Marseus Schrieck, Evert	-0.544 *	(-1.95)	9
Lievens, Jan (I)	0.586 ***	(3.84)	39	Mulier, Pieter (I)	-0.584 ***	(-3.06)	32
Porcellis, Jan (I)	0.583 ***	(3.8)	52	Spruyt, Johannes	-0.594 *	(-1.75)	6
Ruisdael, Jacob Isaacksz	0.546 **	(2.45)	16	Treck, Jan Jansz.	-0.611	(-1.49)	4
Wouwerman, Philips	0.542 ***	(2.89)	23	Does, Jacob Van Der (I)	-0.633	(-1.57)	4
Bol, Ferdinand	0.533	(1.6)	6	Pietersz., Gerrit	-0.635 **	(-2.18)	9
Geldorp, Gortzius	0.514	(1.44)	6	Grimmer, Jacob	-0.674 *	(-1.75)	5
Velde, Adriaen Van De	0.504	(1.48)	6	Moeyaert, Claes Cornelisz.	-0.689 **	(-2.05)	6
Hue, Lambertus Jansz. De	0.504	(1.35)	5	Lang, Willem Arentsz. De	-0.780 *	(-1.90)	4
Heda, Willem Claesz.	0.501	(1.35)	5	Assteyn, Bartholomeus	-0.809 ***	(-2.61)	9
Hooch, Pieter De	0.499 *	(1.66)	8	Hals, Harmen	-0.818 **	(-2.24)	5
Poelenburgh, Cornelis	0.498 ***	(2.66)	24	Hulst, Maerten Fransz	-0.819 **	(-2.03)	4
Decker, Cornelis Gerritsz.	0.480 *	(1.74)	9	Heer, Gerrit Adriaensz	-0.868 **	(-2.16)	4
Cappelle, Jan Van De	0.476	(1.48)	7	Blommendael, Reyer	-0.876 *	(-1.87)	3
Vinckboons, David	0.468	(1.62)	9	Linschoten, Adriaen	-0.925 *	(-1.91)	3
Cuyp, Aelbert	0.464	(1.54)	9	Brize, Cornelis	-0.929 **	(-2.52)	5
Droochsloot, Joost	0.441 **	(2.43)	34	Verbeeck, Cornelis	-0.945 ***	(-3.32)	9
Ostade, Isaack Van	0.424	(1.03)	4	Verhaert, Dirck	-1.032 ***	(-5.14)	21
Beerstraten	0.407 *	(1.65)	12	Vries, Guiliam De	-1.087 ***	(-3.39)	7
Bloemaert, Abraham	0.378	(1.52)	15	Hulst, Franz De	-1.161 ***	(-3.21)	5
Grebber, Pieter Fransz.	0.375	(1.26)	8	Volder, Joost De	-1.170 **	(-2.52)	3
Roghman, Roeland	0.369	(1.01)	5	Vonck, Elias	-1.201 ***	(-4.58)	11
Groningen, Swart Jan	0.352	(1.04)	8	Fris, Jan	-1.218 ***	(-2.61)	3
Flinck, Govaert	0.342	(1.02)	6	Eemont, Adriaen Van	-1.305 ***	(-2.79)	3
Vlieger, Simon De	0.319	(1.65)	21	Gras, Willem	-1.335 ***	(-3.22)	4
Coninxloo, Gillis Van	0.317	(1.14)	11	Vinne, Vincent Laurents(I)	-1.389 ***	(-5.71)	13
Savery, Roelandt	0.314 *	(1.94)	48	Cleve, Marten Van (I)	-1.497 ***	(-3.09)	3
Colyn, David	0.313	(1.46)	21	Leemans, Anthony	-1.625 ***	(-3.43)	3
Nieulandt, Willem (II)	0.309	(1)	8	Potuyt, H.	-1.698 ***	(-3.61)	3
Steen, Jan	0.297	(0.72)	4	Beelt, Cornelis	-1.759 ***	(-3.82)	3
Neer, Aert Van Der	0.282	(1.56)	26	Streeck, Juriaen Van	-1.958 ***	(-4.16)	3
Zijl, Gerard Van	0.281	(1.12)	12	Schooten, Floris Gerritsz.	-1.994 ***	(-4.88)	4

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A. 2 – Artists Fixed Effects in Auctions (with number of paintings)

Artist	Coef	t-st	obs	Artist	Coef	t-st	obs
Dou, Gerard	2.364 ***	(4.01)	3	Pynas, Jan Symonsz.	0.391	(1.09)	7
Leyden, Lucas Van	2.035 ***	(3.22)	3	Vlieger, Simon De	0.382	(1.1)	7
Asselyn, Jan	1.966 ***	(4.75)	10	Pynacker, Adam	0.372	(1)	6
Bruegel, Pieter (I)	1.592 ***	(4.27)	6	Molenaer, Jan Miense	0.343	(0.96)	6
Vrancx, Sebastian	1.586 ***	(2.7)	2	Wyck, Thomas	0.333	(0.89)	5
Soest, Pieter Cornelisz.	1.446 ***	(3.28)	4	Badens, Francesco	0.32	(0.74)	4
Loo, Jacob Van	1.441 ***	(3.04)	3	Ruisdael, Jacob Isaacksz	0.306	(0.82)	5
Bruegel, Jan (I)	1.390 ***	(4.41)	10	Saftleven, Herman	0.303	(0.73)	4
Lingelbach, Johannes	1.386 ***	(5.08)	10	Stalpaert, Pieter	0.284	(0.83)	8
Vermeer, Johannes	1.321 ***	(5.91)	22	Bol, Hans	0.284	(0.63)	4
Borch, Gerard Ter (II)	1.299 ***	(3.04)	6	Conincxloo, Gillis Van	0.269	(1.04)	17
Holsteijn, Cornelis	1.274 **	(2.22)	2	Scorel, Jan Van	0.261	(0.52)	4
Steenwijck, Hendrick (II)	1.202 **	(2.06)	2	Hooch, Pieter De	0.209	(0.57)	6
Wouwerman, Philips	1.192 ***	(4.75)	12	Nieulandt, Adriaen Van	0.174	(0.55)	8
Heem, Jan Davidsz. De	1.171 **	(2.35)	3	Wouwerman, Pieter	0.166	(0.52)	7
Both, Jan	1.160 ***	(3.07)	11	Stuven, Ernst	0.161	(0.34)	4
Dyck, Anthonie Van	1.135 ***	(3.76)	9	Jordaens, Hans (III)	0.146	(0.45)	8
Aelst, Willem Van	1.132 ***	(3)	7	Verelst, Simon Pietersz.	0.142	(0.31)	4
Ostade, Adriaen Van	1.125 ***	(3.04)	6	Jansz., Govert (Mijnheer)	0.135	(0.44)	11
Laer, Pieter Van	1.116 ***	(4.3)	25	Marseus Schrieck, Otto	0.124	(0.46)	11
Rubens, Pieter Paul	1.115 ***	(4.14)	15	Ochtervelt, Jacob	0.121	(0.37)	8
Cleve, Marten Van (I)	1.100 **	(2.14)	3	Victors, Jacobus	0.091	(0.22)	5
Droochsloot, Joost	1.092 ***	(2.93)	6	Mander, Karel Van (I)	0.087	(0.39)	36
Dujardin, Karel	1.091 ***	(3.65)	8	Lievens, Jan (I)	0.085	(0.28)	9
Molenaer, Cornelis	1.086 *	(1.83)	2	Moucheron, Frederick De	0.012	(0.04)	11
Hondecoeter, Melchior De	1.022 ***	(3.48)	14	Pietersz., Gerrit	0.005	(0.01)	7
Heemskerck, Maerten Van	0.955 ***	(2.62)	9	Hondecoeter, Gillis De	-0.012	(-0.04)	8
Honthorst, Gerrit Van	0.948 **	(2.22)	4	Piemont, Nicolaes	-0.018	(-0.05)	5
Velde, Adriaen Van De	0.936 ***	(2.65)	6	Francken, Frans (II)	-0.024	(-0.06)	4
Zijl, Gerard Van	0.916 ***	(3.33)	15	Isaacksz., Pieter Frans	-0.039	(-0.11)	7
Vertangen, Daniel	0.847 **	(2.44)	6	Huchtenburgh, Jan Van	-0.057	(-0.15)	6
Lastman, Pieter	0.846 ***	(3.06)	14	Backer, Jacob Adriaensz.	-0.067	(-0.16)	4
Rottenhammer, Hans (I)	0.808 *	(1.65)	7	Vermeer, Jan (II)	-0.071	(-0.19)	5
Jordaens, Jacob	0.799 ***	(2.77)	12	Graat, Barent	-0.072	(-0.17)	4
Berchem, Claes Pietersz.	0.780 ***	(3.29)	20	Vroom, Hendrick	-0.079	(-0.23)	7
Kalf, Willem	0.780 **	(2.42)	9	Pynas, Jacob Symonsz.	-0.09	(-0.18)	6
Steen, Jan	0.765 ***	(3.1)	19	Mommers, Hendrik	-0.1	(-0.27)	5
Teniers, David (II)	0.758 **	(2.29)	9	Brakenburg, Richard	-0.128	(-0.30)	5
Barendsz., Dirck	0.738 *	(1.96)	6	Bloemaert, Abraham	-0.141	(-0.36)	5
Witte, Emanuel De	0.697 ***	(2.94)	14	Toorenvliet, Jacob	-0.352	(-1.19)	12
Broeck, Crispiaen Van	0.69	(1.44)	4	Bergen, Dirk Van	-0.407	(-1.03)	5
Weenix, Jan, De Jonge	0.604	(1.35)	4	Oolen, Adriaen Van	-0.41	(-0.92)	4
Cornelisz. Van Haarlem	0.599 **	(2.42)	22	Berckheyde, Job	-0.449	(-1.29)	6
Both, Andries Dircksz.	0.587	(1.55)	8	Moucheron, Isaac De	-0.556	(-1.14)	4
Momper, Joos De	0.586 **	(2.18)	14	Goyen, Jan Josephsz. Van	-0.675 *	(-1.75)	5
Aertsen, Pieter	0.570 **	(2.08)	24	Engels, Bartholomeus	-0.683	(-1.51)	5
Poelenburgh, Cornelis	0.563	(1.17)	4	Savery, Jacob (I)	-0.725 **	(-2.33)	10
Savery, Roelandt	0.541 **	(2)	13	Huysum, Justus Van (I)	-0.812 **	(-2.19)	8
Lairesse, Gerard De	0.538 **	(1.98)	16	Nagel, Jan	-0.814 ***	(-3.26)	18
Porcellis, Jan (I)	0.493	(0.84)	6	Wet, Jacob Willemsz. De	-0.957 ***	(-3.61)	11
Avercamp, Hendrick	0.448	(1.2)	6	Couwenberg, Philips Van	-1.039 *	(-1.82)	3
Brouwer, Adriaen	0.444	(1.32)	15	Blanckerhoff, Jan Theunis	-1.069 **	(-2.24)	3
Metsu, Gabriel	0.441	(1.02)	4	Floris, Frans (I)	-1.169 **	(-2.54)	5

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$