THE LABOR MARKET IN THE ART SECTOR OF BAROQUE ROME

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Abstract

We analyze the labor market for painters in Baroque Rome using unique panel data on primary sales of portraits, still lifes, genre paintings, landscapes and figurative paintings. In line with the traditional artistic hierarchy of genres, average price differentials between them were high. The matched painter-patron nature of the dataset allows us to evaluate the extent to which price heterogeneity is related to unobservable characteristics of painters and patrons. We find that the market allocated artists between artistic genres to the point of equalizing the marginal return of each genre. We explain residual price differences at the employer level in terms of incentive mechanisms to induce effort in the production of artistic quality and compensating wage differentials.

Keywords: Inter-industry wage differentials, Matched employer-employee data, Occupational choice, Art market

JEL Classification: C23, D8, J3, Z11

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"Caravaggio said that it takes as much manufacture to do a good painting of flowers as of human figures," Vincenzo Giustiniani, Letter on painting (1620-1630)

1   Introduction

Rational and equilibrium behavior has characterized economic phenomena since the development of free market economies, but the lack of reliable data on pre-industrial markets has made it difficult to test economic theories in historical contexts.[1] The art market is an interesting exception, for which data on prices and supply and demand factors are available from art historical studies and economic investigations start to emerge (see O'Malley, 2005; De Marchi and Van Miegroet, 2006a,b; Etro and Pagani, 2012, 2013; Etro and Stepanova, 2013).[2] Here we analyze the XVII century market for painters based in Rome, the leading art center of the Western world at the time, through a unique dataset on paintings of the Baroque age, which allows us to focus on the (occupational) choice of the artistic genre by painters and on equilibrium pricing across art sectors.

The most impressive and rapid phenomenon of the XVII century art industry has been the innovative form of artistic differentiation that led to the mass production of new genres of paintings. Besides traditional figurative paintings, mainly on religious, mythological and historical subjects, and besides portraits, the new genres of the Baroque art market included what were considered "minor genres" such as still lifes (reproducing animals, fruits, flowers and lifeless objects), landscapes (reproducing the countryside or the urban environment), so-called genre paintings (reproducing daily life scenes) and battles (reproducing fights without necessarily a specific historical content). Each genre represented a specific sector of production (with limited substitutability between genres on the demand side), and painters either specialized in one or few genres or they could switch between them according to market opportunities.

The prestige of the genres was rigorously ranked in the artistic culture of the time and the most dignified and worthy subjects were those depicting creative compositions of idealized human figures, as in religious and mythological paintings. Behind these, a relative preference was reserved for landscape paintings, which had to represent idealized views of the world. Compositions of the daily aspects of reality, the so-called genre paintings, were at a lower level in the ranking of the art commissioners, while the least worthy genres were those imitating re-

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[1] With some remarkable exceptions, see for example Ackerberg and Botticini (2002) who analyze the choice of agrarian contracts in early Renaissance Tuscany.

[2] Ashenfelter and Graddy (2003) survey the wide literature in cultural economics on hedonic regressions for the price of paintings. The focus of this literature, however, is on modern auctions rather than on historical sales. Only recently the focus has switched to historical data on primary and secondary sales.

ality without idealization like portraits and, at the lowest level, still lifes.[3] Such a ranking of preferences for the genres was well understood between art collectors, art critics and artists, and later codified by the art academies. A preliminary look at our data on primary sales of paintings suggests that this hierarchy was also associated with a clear ranking of payments among the different genres. Price differentials between them were sizable: the average prices in Roman silver *scudi* were, respectively, 17 *scudi* for still lifes, 25 for genre paintings, 39 for portraits, 66 for landscapes and 240 for all the figurative paintings (with further differences between sub-categories).

Paintings of different genres obviously differed in many respects (e.g., size, technique, support, destination) and price differentials did not necessarily reflect differences in the effective compensation of the painters. However, as long as the market was competitive and painters could freely choose whether to specialize in one genre or switch between genres to exploit profitable opportunities, we can hardly imagine that systematic compensation differentials could persists between artistic sectors. In other words, in equilibrium, painters should have been allocated between commissions to the point of equalizing the marginal return of each genre.

Our main objective is to test this hypothesis of price equalization between artistic sectors. To do so we adopt a labor market framework in which genres are interpreted as industries, patrons as the employers and painters as the workers. Rather than wages (e.g. annual or hourly wages, as in the standard labor market literature) our data report the price of each single item (painting) produced by each artist. In labor economics terms, we would define the compensation for each painting (i.e., the painting price) as a compensation at a piece rate rather than at a time rate. If artists's mobility between artistic fields (genres) was free, we expect that, after controlling for demand and supply side features, any price differential between paintings of different genres should disappear.

In labor economics, a similar hypothesis has been largely investigated in the literature on inter-industry wage differentials. The first strand of studies on this topic (Dickens and Katz, 1987; Murphy and Topel, 1987; Krueger and Summers, 1988; Gibbons and Katz, 1992) found that substantial wage differentials across sectors (and firms) exist that cannot be explained by observable worker or firm characteristics. Accordingly, standard competitive theories of the labor market could hardly rationalize this evidence:[4] one would need to complement them taking into account compensating wage differentials or market frictions associated with efficiency wages (informational frictions) or imperfect mobility of workers (search frictions). Still, common to all

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[3]See Spear and Sohm (2010, p. 91).

[4]Which is true also in the case of highly skilled workers such as the painters of our dataset (e.g., see Bertrand *et al.*, 2010).

of these early studies is the lack of appropriate data to control properly for unobservable characteristics of workers and firms. In other words, the main empirical problems in explaining wage differentials typically relied on the difficulty of obtaining detailed matched employer-employee datasets about a competitive labor market and observing the same worker employed in multiple sectors and in different firms (without selection on workers switching jobs).

More recently, the emergence of new datasets linking employers and employees has made this possible. The seminal work of Abowd *et al.* (1999)[5] has readdressed the topic of wage differentials by using unique longitudinal matched employer-employee data of French workers and firms: given the matched nature of their panel, they can control simultaneously for workers and firms fixed effects, and they find that most of the inter-industry wage differential is explained by worker effects. Since then, the availability of new data matching workers to their employers fostered interest for this topic.[6] The basic message of this literature is that unobserved worker and firm characteristics matter a lot for wage determination but, although the inclusion of individual and employer heterogeneity considerably reduces inter-industry differentials, significant differences in wage levels across sectors persist.

Our empirical analysis follows the spirit of this literature looking at a unique dataset on painters active in Rome in the XVII century, put together by the art historian Richard Spear and administered by the Getty Research Institute (see Spear and Sohm, 2010). The dataset provides a lot of information on the observable features of the commissions, of the paintings, and of the painters.[7] Most of all, our dataset is a matched employer-employee (patron-painter) dataset and hence it allows us to analyze the inter-industry (genre) price differential exploring the role of worker (artist) and firm (patron) heterogeneity in the determination of painters' compensation. The advantage of analyzing a primary artistic market through a matched employer-employee dataset is that we can observe workers (painters) that are constantly switching between sectors (genre of paintings) and between employers (patrons). Moreover, since differences in the artistic ability (talent) were painter-specific and quintessentially unobservable (i.e., non measurable), we fully capture them through artists fixed-effects. Finally, unlike in the standard literature in

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[5]See also Goux and Maurin (1999) and more recently Gruetter and Lalive (2009) and Woodcock (2008) for related analysis.

[6]For instance, after decomposing wage rates into a worker effect and a firm effect, Abowd *et al.* (2001) and Abowd *et al.* (2013) compute the share of inter-industry wage differences attributable to worker and to firm effect in France and USA. The second work relates the part arising from individual heterogeneity to the worker's opportunity wage rate and the part arising from employer heterogeneity to product market quasi-rents and relative bargaining power. Moreover, different modeling techniques have been developed to address the econometric challenges related to longitudinal matched employer-employee data (see the survey in Abowd *et al.* 2008). Recently, Card *et al.* (2012) have used the methodology to investigate the evolution of wage inequality.

[7]We know the age at which painters executed the works: since they received a similar general training before becoming independent masters, but kept training and improving their ability and reputation with time, on-the-job experience is the main observable characteristic of the painters that we use.

labor economics, in which each firm could be classified into a single industry only, our data allow us to identify sectors and patrons disjointly: each patron could commission paintings belonging to different genres (or sectors).[8] Our main contribution is then related to the specific features and to the novelty of the data which allow us to analyze, for the first time, an historical labor market of high skilled workers.

The main result we obtain is that, after controlling for demand and supply conditions, all the price differentials between genres disappear or become insignificant, which suggests that the labor market for painters must have been rather competitive and allocated artists between genres to the point of equalizing the marginal return of the different artistic sectors. This is remarkable since we find one of the earliest microeconometric evidence of a competitive mechanism at work in a labor market of very high skilled workers producing highly differentiated goods; earlier findings of wage equalization in the literature were based on data on highly interchangeable blue and white-collar workers producing similar goods and services. Moreover, the results are reinforced by the fact that we analyze a market populated by a relatively small number of agents on both sides of the market, while the empirical literature on industry wage differential is generally based on administrative data with thousands of observations.[9] Another advantage with respect to the existing literature on inter-industry wage differentials is that in our case the workers (artists) produce a consumption good for the final consumers and they are not hired as inputs in the production of goods to be sold on another market: hence, the firm (patron) bargaining power on the product market and the rents stemming from it are not a source of price differentials.

While arbitrage appears to hold between genres and also between geographical destinations, we find some evidence of residual price differentials at the employer level, which we mainly explain in terms of incentive mechanisms to induce effort in the production of artistic quality and compensating wage differentials. Interesting results are related to the moral hazard problem emerging in contractual relations for figurative paintings in which effort of painters and final quality of paintings were not contractable *ex ante* or verifiable *ex post*. First, in the case of religious, mythological and historical paintings, we show that patrons and artists adopted a typical solution pointed out in the literature on principal-agent contracts: prices were made conditional on measurable features of the paintings which were positively correlated with effort

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[8]In labor terms, sector or industry is a characteristics of the firm, thus the definition of the pure industry effect (for example in Abowd *et al.*, 1999) is simply the correct aggregation of the pure firm effect within the industry. This is not the case in our context.

[9]For instance, Abowd *et al.* (1999) study a longitudinal sample of the French labor market with over one million workers from more than five hundred thousand employing firms. We may add that unionization and minimum wages are relevant constraints to competitive mechanisms in such a modern labor market, while they were absent in our market.

and quality (Holmstrom and Milgrom, 1991), one of which was the number of human figures per square meter in the composition. Second, we find a price premium for altarpieces destined to public display as in private chapels (within public churches) which we interpret as evidence of a signalling mechanisms in the commissions by private patrons of artworks which were visible by the entire community (Spence, 1973; Nelson and Zeckhauser, 2008).

We find residual price premia paid by foreign kings and foreign families, such as the Medici from Florence and the Gonzaga from Mantua. Following the decomposition of variance in Gruetter and Lalive (2009), we show evidence of negative sorting and on this basis we argue that the most convincing explanation for this is related to compensating wage differentials rather than efficiency wages. We emphasize that the best paid artists (for works of similar objective characteristics and destination) included famous masters such as Maratta, Pietro da Cortona, Guido Reni, Caravaggio, Vouet, Lorrain and Poussin. Finally, the rewards of the painters were increasing with age, consistently with the importance of on-the-job experience in the artistic market, possibly due to the development of experimental innovations (Galenson, 2006).

The paper is organized as follows. Section 2 describes product differentiation in the market for paintings and the economic hypothesis to be tested. Section 3 illustrates the dataset. Section 4 describes the empirical strategy and the results, and performs some robustness checks including a two stage hedonic estimation with alternative selections of the data. Finally, Section 5 concludes.

2 Price equalization between genres of paintings

Most paintings during Renaissance were of figurative subject, mainly religious or mythological, but also allegorical, literary or strictly historical (including battles drawn from a real or invented context), and we define these as figurative paintings. Since the end of the XVI century, however, the raising demand of private buyers belonging to the high and middle classes (and the influence of Nordic art) led to the development of new artistic subjects, usually regarded as minor genres, such as still lifes, landscapes and so-called genre paintings (depicting ordinary daily life). These minor genres flourished during the Baroque age of the XVII century.[10]

On the demand side, the substitutability between genres was limited because of the different decorative roles that the different genres had in private homes and churches (for instance,

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[10]The pressure for horizontal differentiation induced even additional specialization within genres, leading to special submarkets for still lifes of flowers, fruits, game, fish or *trompe-l'oeil*, to submarkets for landscapes focused on seascapes, rural scenes, views of the countryside with classic ruins, *vedute* (cityscapes), on *capricci* (imaginary views).

portraits had a different purpose than landscapes within a private building, and only religious paintings could be destined to churches). On the supply side, some painters were mainly, but not exclusively, specialized in one of the artistic sectors, others were often engaged in combinations of them, and many more were switching genres repeatedly in their careers (think of Caravaggio, Annibale Carracci or Salvator Rosa to cite some famous eclectic artists).

While nowadays we are not used to artistic hierarchies based on paintings' subject, in the XVII century the prestige of the different artistic genres was clearly ranked. The least worthy subjects were still lifes, imitating inanimate reality without idealization (Spear and Sohm, 2010, p. 91). The position of portraits in this hierarchy was variable, but often at a low level for the alleged absence of creativity in works aimed at merely copying real human figures. Genre paintings were equally penalized by the lack of decorum and idealization and the typical focus on the worst aspects of life, which was considered vile by contemporary artists and critics (Spear and Sohm, 2010, p. 94). Landscapes and (even more) battles were more valuable than these genres because of their idealized depictions. The most dignified and worthy subjects were those depicting creative compositions of ideal human figures (Spear and Sohm, 2010, p. 91), like historical paintings, and, most of all, religious and mythological paintings.

There is wide documentary evidence that such a ranking of preferences (and willingness to pay on the demand side) was well understood between art critics, art collectors, artists and intellectuals.[11] Later in the century, it was even codified by the art academies.[12] The prestige of different genres was closely correlated with the fame of painters. The most acclaimed artists were mainly engaged in figurative subjects and they reached fame and also the highest payments for these paintings, while minor painters were mainly engaged in minor genres such as still lifes and genre paintings and they received lower compensations for them.

Nevertheless, since the basic training (in different genres and techniques) was more or less common to most artists (since Renaissance), as long as the market was competitive and the alternative artistic genres were open to the entry of new painters, we can hardly imagine that systematic differences in prices could persists over time between different genres. Painters

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[11] Vincenzo Giustiniani (1564-1637), a famous art collector, in a letter distinguished twelve "categories, concerning both the methods of painting and the rankings of painters" with a clear hierarchy (see Enggass and Brown, 1970). The worst three categories, or "methods" concerned copies. At a higher level of Giustinani's ranking were portraits and still lifes. At an even higher level he placed different kinds of landscape paintings. The best categories were about figurative paintings, including battles and, a step above, historical subjects divided in subcategories differentiated only from a stylistic point of view. Similar views were expressed by other experts in the following decades.

[12] The hierarchy of genres became a source of intellectual debate in the European art academies. A shared view was later codified in a famous lecture given by the art critic André Félibien at the French Academy (*Conferences de l'Académie Royale de Peinture et de Sculpture pendant l'année 1667*). His influential hierarchy of the genres, ranked still lifes in the lowest position and figurative paintings at the highest level.

of different talent could perfectly choose to be active in different sectors, but if a given painter could earn more by switching between genres, this would happen whenever a painting in another genre could provide a higher compensation.[13] The only differences consistent with a competitive mechanism could be motivated by compensating differentials, which at the time were associated with the social connections that a certain patron could provide to the painter (providing new and certain commissions in the future). But beyond exceptional circumstances, a standard arbitrage argument suggests that, after controlling for observable characteristics of the paintings such as size, technique or support, and unobservable characteristics of painters and commissioners, any price differential between paintings of different genres should disappear.[14]

2.1   Price determinants: the supply-side

To test the hypothesis of price equalization between genres, we need to identify the main supply and demand factors that may have affected prices in the market for paintings of Baroque Rome. On the supply side, the price of paintings depends first of all on the talent and the reputation of the painter, which is obviously painter-specific: the reservation price of painters was clearly increasing in their innate ability, for instance because better painters had more outside options. Moreover, the ability to produce high quality could change with the experience of each painter: the latter may reflect an age/earning profile dependent on reputational effects emerging with the activity in the profession (in a Mincerian tradition) or on actual improvements, that is artistic innovations perceived and priced by the market, that require a certain experience (Galenson and Weinberg, 2000; Galenson, 2006).

Other sources of price differential that derive from the supply side are painting-specific. The most important and measurable feature is the size of paintings, which reflects the cost of production and captures many things such as the complexity of the conception as well as the need of assistants, possibly increasing less than proportionally with dimension because of scale economies. With regard to figurative paintings, also the number of figures depicted could have been increasing the cost of production and therefore the price; however, once controlling for size, it is not clear if this was still true. Another factor is the originality of the work: even if the concept of autography was quite different from our modern understanding (plagiarism was

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[13]In a Schumpeterian perspective, the same innovation of new genres in the Baroque period can be justified by the new economic compensation that minor genres started to deliver to the painters. See Etro and Pagani (2013) on Schumpeterian patterns in the Venetian art market.

[14]Notice that we are not claiming that each artist was equally good in each genre, because clearly there could be different talents and skills in different genres (and specialization could induce improvements in a single genre and not in the others). Our hypothesis is that if artists could switch between genres, they would do it whenever painting a different genre could provide a higher payment. Therefore, any equilibrium would allocate works (and workers) between genres to the point of equalizing prices.

not a legal issue), copies, often done by minor painters, implied less work because they did not require a preliminary creative activity.

The technique adopted could substantially affect costs of production and prices: compared to oil paintings, frescoes required a complex preparation (think of ceilings and cupolas, or even large walls) but also a rapid execution, which could have an ambiguous impact on costs.[15] Beyond the different costs of production, frescoes (which were common mainly for figurative paintings and landscapes) provided a different esthetic perception (and commitment due to the fixed position) within churches and private residences and, therefore, they could command different prices. Whether frescoes were paid more or less than oil paintings remains an open question to be settled at the empirical level. Finally, in case of oil paintings, the support could also affect prices: most oil paintings were executed on canvas, but few others of small size were executed on copper support or other smooth material (commonly, still lifes and landscapes).[16]

2.2 Price determinants: the demand-side

If we move to analyze the demand side, we expect that different patrons could have different willingness to pay. Our dataset is rich of information that is useful to identify the patrons (mainly churches or noble and rich families), the geographical destination of the commission (Rome, a minor destination in the countryside, a medium city or a place outside Italy), the purpose of their commissions (a private collection and residence, a religious institution or a private chapel within a church) and its kind (for a single or multiple paintings). This allows us also to check for various motivations behind price differentials generated by different willingness to pay by different patrons.

A first source of price differentials consistent with a competitive market is due to different non-monetary rewards (on *compensating wage differentials* see Hwang *et al.*, 1992). If painters had more to gain from commissions from well connected Roman families able to guarantee future commissions or network with other patrons and less to gain from occasional and riskier commissions from foreign families, they could be indifferent between lower prices for the first kind of commissions relative to the second one. It is likely that this induced negative sorting

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[15] As Spears (2010) notices, "[m]ore data are required before it can be said if it definitely was cheaper to paint in fresco than oil, not only because there were so many variables in the quality and quantities of pigments used in different jobs, but also because a fresco painter might or might not have been responsible for the cost of preparing a wall, or an oil painter for buying his canvases and stretcher. I suspect that generally fresco was the cheaper medium by measure, but even so that does not take into account the overhead of hiring more assistants for elaborate projects" (pp. 56-7).

[16] The cost of expensive oil colors (such as ultramarine blue, which was derived from *lapis lazuli*) was usually paid by the commissioner in a separate way (Spear and Sohm, 2010). Frames were also paid separately by the commissioners in most cases during this century.

between artists and patrons: first because better artist looked for safer patrons that paid less for a typical income effect on the supply side (as in labor markets where high wage earners purchase safer jobs),[17] and second because in front of higher prices (for given quality) patrons tended to look for lower paid artists (offering lower quality) for a substitution effect on the demand side.

Other sources of price differentials rely on market frictions due to imperfect observability of workers' effort and non-contractability (*ex ante*) of paintings' quality.[18] Theories of *efficiency wages* provide a variety of explanations for differential compensations. On one side, since the reservation price of painters was increasing in their ability, patrons could pay more in order to attract the best painters (Weiss, 1980). On the other side, we may expect that the most susceptible-to-quality patrons were more prone to provide monetary incentives to induce effort of the painters, and these were ready to exert higher effort to avoid the risk of working for ordinary patrons (Shapiro and Stiglitz, 1984) or to be paid as painters of lower quality. A common aspect of these models is positive sorting between artists and patrons. This is obvious in models of pure asymmetric information where higher wages are used to select more productive workers. In models with asymmetric information and moral hazard, it is the standard sorting condition that induces positive sorting: more productive workers find it more convenient to choose high wage-high effort contracts relative to low wage-low effort contracts and the first kind of contracts are offered exactly to screen the best workers and increase their effort. Another screening mechanism that can emerge in such a context has to do with *quantity discounts*: contracts for multiple paintings would imply lower unitary prices as a form of second degree price discrimination aimed at attracting patrons with higher willingness to pay.

As we could expect from basic contract theory, a variety of additional incentive mechanisms could emerge in case of figurative paintings, for which contractual agreements were mostly established *ex ante* and were subject to moral hazard. We emphasize one aspect related to signalling and one related to optimal principal-agent contracts.

First, as pointed out by Nelson and Zeckhauser (2008), commissions of altarpieces and frescoes for private chapels within public churches were visible to the entire contemporary audience, and could guarantee high visibility for their patrons in front of the fellow citizens, of the political and ecclesiastic power (and even of God) and signal what at the time was called "magnificence". In this sense we can test a *signalling* mechanism *à la* Spence (1973) for artistic commissions: commissioners were ready to invest more to obtain higher quality works when a mechanism of signalling of "magnificence" was active, therefore we expect higher prices for paintings addressed to private chapels as compared to common religious commissions and especially as compared

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[17]See the discussion in Hwang *et al.* (1992) and Gruetter and Lalive (2009).

[18]We ignore imperfect mobility of workers, because this was unlikely to be relevant in our market.

to other private commissions which were not destined to public display (such as private palaces and private collections).

Second, let us look at the optimal patron-artist contracts from the perspective of *principal-agent theory*. Since reputational constraints and efficiency wages did not perfectly align the incentives of patrons and artists, there was room for further contractual solutions to the moral hazard problem. In line with the "informativeness principle" (see Holmstrom and Milgrom, 1991), it is reasonable to believe that the optimal patron-artist contracts had to be based, explicitly or implicitly, on any verifiable and measurable feature of the painting that was correlated with effort and quality. The number of figures could be taken as a proxy for effort and quality for two main reasons. First of all, the variety and complexity of the composition of human figures invented by the artist had a positive, though partial, correlation with quality, and could be summarized exactly by the number of figures. For instance we know that pricing by number of figures became a typical procedure during the early 600s for leading painters such as Guercino, Domenichino and Guido Reni.[19] Second, the same hierarchy of genres could provide a link between number of figures and perceived quality: a higher number of human figures was increasing on average the space destined in the painting to subjects of higher perceived value (the human figures) and reducing the space available for subjects of lower quality (background landscapes or decorative still lifes).[20]

Taking all this in consideration, we can reformulate our hypothesis of price equalization between genres in a more appropriate way. Price equalization should hold, after controlling for observable and unobservable characteristics of artists and patrons, between still lifes, genre paintings, landscapes, portraits and all the figurative paintings with a small number of human figures, allowing for increasing price premia when the figurative paintings contained a higher number of figures.[21]

Finally, we also test whether arbitrage was taking place not only between genres but also between big cities and the countryside. More specifically, we expect that prices for paintings

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[19]Guercino claimed to commit to a fixed price of 100 scudi per full-lenght figure (50 for half-lenght figure, 25 for heads); however, this could be part of a sophisticated bargaining technique because deviations from this "commitment" were the rule rather than the exception. In a letter of 1628, Guido Reni argued that the low level painters could not obtain more than 2 or 3 scudi for large life-size figures and ordinary painters could ask at most 15 scudi per figure, while an extraordinary painter like himself could name his own price on the basis of the quality of his work independently from size and number of figures (Spear and Sohm, 2010).

[20]Moreover, painters were often focusing their own effort on human figures and especially on difficult parts as the heads, delegating less relevant parts (including background decorations, landscapes and still lifes) to their own assistants. Accordingly, a higher number of figures was a proxy for a wider direct intervention of the master painters in the overall execution, and consequently for higher quality.

[21]To be as conservative as possible, we define figurative paintings with a small number of figures as those with at most four human figures. This is particularly conservative for our purposes because portraits depicted almost always a single human figure.

destined to big and rich cities (where wealthy demand was) should not be significantly different from prices of paintings destined to small towns and villages in the countryside, otherwise profitable opportunities for provincial painters would have been unexploited. However, notice that this goes against the common perception at the time, for which Rome was the best paying market (Spear and Sohm, 2010).[22]

3   Data

In this section we provide an accurate description of the dataset and of the variables we consider as price determinants in the empirical analysis, and we show some descriptive statistics.

3.1   Description of the dataset

The empirical analysis is based on a unique dataset established at the Getty Research Institute (the *Payments to Artists Database*, hereafter PAD) which documents payments directly made to artists for the primary market in XVII century Rome (Spear and Sohm, 2010).[23] The dataset contains approximately a thousand records of payments to artists and provides a lot of precious information regarding paintings' and painters' characteristics. To the aim of our analysis, the most valuable characteristic of the PAD is that it is a matched employer-employee (patron-painter) dataset.

The source of the information includes original contracts between artists and patrons (typically for the altarpieces), records of the buyers themselves (typically for the minor genres, which were not contracted in detail), evidence from contemporary writers, archives and inventories. The survival of all this information for these painters and patrons through centuries is random, but it is quite reasonable that most of the information found by art historians actually concerns well known painters dealing with famous and wealthy patrons. Therefore, we need to be aware that this selection excludes from the analysis the lower end of the art market, which was populated by largely undistinguished craftsmen supplying low quality products without any formal agreement with the buyers. On the other hand, such selection allows us to focus on the upper end of the art market where in general the most famous painters were directly competing with

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[22]In 1625, Fra Atanasio, an art dealer who was negotiating an altarpiece by Giovanni Battista Crespi called Cerano in Milan, told the patron that the painter would have probably accepted 250 scudi, but also that if Cerano were to go to Rome he would be paid double because, he added, Rome is "where you go to get rich" (Spear and Sohm, 2010, p. 233).

[23]The original dataset is available online at:
http://www.getty.edu/research/tools/provenance/payments_to_artists/index.html.

each other.[24]

In PAD, the information of a typical "arrangement" between the artist and the patron concerns the record's number, the artist's name, the title, the subject, the object, the dimension, the number of figures, the patron's name, the payment date, the price paid and the destination (both the original and the current one). Finally, the records often contain interesting notes providing further details on the contract, when available. Table 1 describes the structure of the typical arrangement in PAD.

INSERT TABLE 1

The original records in the dataset could refer either to a single or to a multiple commission (i.e., more than one painting for the same artist-patron contract). When multiple commissions are taken into account, the total number of single observations increases to about a thousand and five hundred observations. Whether a painting belongs to a single or to a multiple commission is generally explicitly indicated in its title. Knowing the number of paintings for each commission enable us to control for a possible discount premium. The painting's title also reports whether each painting represents a copy rather than an original work.

The painting's price is the dependent variable of our econometric analysis. The given value is the amount paid to the artist in silver *scudi romani*; in some cases prices were converted from another currency (such as doubloons, gold *scudi*, *livres tournois*, spanish real and pound sterling).[25] In the rare cases in which prices do not represent an original payment to an artist they are identified as evaluation prices or sale prices. In these cases, however, prices are restricted to the years when the artist was selling his works because they are probably more representative of the original sale prices.[26]

In PAD, the "subject" is identified as: sacred, mythological, allegorical, history, heraldic, literary, battle, landscape, architectural, portrait, genre, still life or animals. In order to obtain variables with an easier interpretation and to link them with the traditional artistic subject classification, we aggregated more homogeneous genres among themselves. As a result, we obtained the following classification: 1) *Sacred*, 2) *Myth* (mythological and allegory), 3) *History*

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[24]The dataset presents quite a few missing values, which in fact markedly reduced the total number of available observations. More specifically, we decided to delete all the records containing simultaneous missing information on the subject (or genre), title and dimension. However, in order to obtain a number of observations as large as possible we decided to make a few guesses regarding the missing values of a given variable, provided that all the other crucial information was certain. All these guesses are described more precisely in a Data Appendix available on request.

[25]Notice that some payments were made in kind (with wine, wheat, cheese, diamonds, even flowers and marzipan): however, their equivalent cash value is cited in the documents and reported in PAD.

[26]Since all artists in PAD (with the notable exception of Artemisia Gentileschi) are male we will use the male pronoun throughout all this work.

(history, literary and heraldic), 4) *Battle*, 5) *Landscape* (landscape and architectural), 6) *Portrait*, 7) *Genre*, 8) *Still life* (still life and animal). We defined the first four groups as belonging to the "figurative" genre, as they involved traditional compositions of idealized human figures, but we will also report the distinction in the four sub-groups in the regressions. The number of figures is also given for these figurative paintings: the full-figure equivalent is reported as a specific number only when the number of figures is lower than five, while full-figure equivalents are more generally designated "5-10" when they vary between five and ten and "crowd" when they are greater than ten or impossible to count.[27]

In the dataset, the "object" refers to both the technique and the support used by the artist. The former includes drawings, etching, fresco, mosaic, oil, tapestry, tempera, watercolor; the latter includes canvas, panel, mirror, copper, lapis, slate, stucco and touchstone. The object also indicates whether a painting was "Easel", which is used to designate what might also be called a gallery picture and which could be taken as an indirect information for its relatively small size when effective size is missing in the dataset. To guarantee a basic homogeneity in the objects under investigation, we dropped the observations when the object referred to drawings, mosaics, tapestries, and watercolors. We do have a few observations for oil paintings with a support different from canvas and characterized by a smooth and compact surface (mostly copper, but also mirror, lapis, wood panel, and others). As a control for the paintings's features we included dummies for oil paintings not on canvas and for frescoes. The dimension has been converted in square meters. In some cases the available information is only about one side of the paintings and some other times only the information "small", "medium", "large" or only the size of the frame are given. In all these circumstances an appropriate estimate was made (sometimes considering the distribution of size of comparable subjects in the sample).

The artist's name could either be the name of a single artist or of more artists, that we considered as co-painters. The artist's name allows us to control for his talent (by including artist fixed-effects) and also to discriminate among painters according to their origin (local or immigrant).[28] Moreover, since the payment date is reported in the dataset, by looking at the painters' biographies we derived the age of the painters at the time in which the artwork was made.

As demand factors are concerned, in most cases we have information on the patron's name,

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[27]In PAD, data were assembled with the method for figure counting used by the Deputies of the Cappella del Tesoro di San Gennaro in Naples in the 1630s. Other than counting what obviously were full or half figures, they counted a certain number of *putti* as the equivalent of a full figure.

[28]Rome attracted many foreign painters, mainly Dutch and Flemish (for instance Both, Bril, Brueghel and Honthorst present in our dataset) or French (such as Lorrain, Dughet and Poussin), who were often focused on the minor genres: mainly still lifes and genre paintings for the Dutch and the Flemish and landscapes for the French.

which indicates the person or the institution that commissioned the painting. Patrons could be churches, other religious institutions (e.g., confraternity or religious orders), the Vatican church of St. Peter or private patrons. These latter were generally noble families residing in Rome, as in the case of the Barberini or the Orsini family, or in other Italian towns, as for the Gonzaga family in Mantua or the Medici family in Florence. Sometimes even the Popes active during the century directly commissioned paintings. Demand for paintings originated also from foreign patrons, both nobles and kings such as Charles I of England or Louis XIV of France. Finally, paintings were occasionally bought by rich dealers, as Mattia Capocaccia, one of the rare traders in paintings, and Fabrizio Valguarnera, apparently trader of (stolen) jewels.[29]

The "destination" in the dataset indicates both the city and the specific location the artwork was addressed to. The majority of paintings was commissioned for the city of Rome. However, the dataset contains many paintings for other important Italian towns, such as Bologna, Florence, Mantua or Naples, for minor provincial centres, such as Caprarola or Frascati, and also for foreign European destinations, such as London, Madrid or Paris. The variable destination allows us also to distinguish between religious and secular locations. Within religious locations we are able to discriminate between the case in which the painting was placed in a family chapel inside a church or in a public space within the church. Secular locations can be private palaces or private collections. Therefore, the demand side can be controlled by patron fixed-effects and by looking both at the city where the painting was addressed to and at the place where the painting was planned to be positioned. This last variable is likely to be related to the willingness to pay of the patrons. Table A1 in the Appendix contains the details of the definitions and sources of the variables included in the regressions.

3.2 Descriptive statistics of the dataset

The payment date in PAD is recorded between 1576 and 1711. In our analysis, however, we slightly reduced the available observations, focusing only on the period from 1600 to 1700, for artistic homogeneity (this is commonly studied as the Baroque century in art history) and also for monetary reasons: the real value of the silver *scudo* is known to have been remarkably stable during that period (see Spear and Sohm, 2010), which allows us to focus on the nominal prices in silver coins without loss of generality. The following descriptive analysis is based on the observations remaining after filtering data from missing values (remaining with 1133 observations). The distribution by genre is shown in Table 2. Notice that the sacred subjects make the largest share of the market. Altogether figurative paintings (i.e. sacred, battle, historical,

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[29]Only in the case of Capocaccia, eight prices derive from a resale (to the Cardinal Francesco Maidalchini), therefore they should be interpreted as an (upperbound to the) estimate of the original prices.

and mythological subjects) represent about 60% of the sample. Around 20% are landscapes, while portraits and still lifes cover 9% of the sample each. At last we find genre paintings, with just about 3% of observations. The associated positive correlation between the production of paintings per genre and the average prices per genre is broadly in line with an adjustment mechanism: in sectors where the willingness to pay was higher more paintings were produced to equalize prices compared to sectors where the willingness to pay was lower.

INSERT TABLE 2

The average price of paintings is 144 *scudi*, although prices exhibit a large variation, ranging between 1 scudo romano for some still lifes and portraits to the 14,000 *scudi* of the huge fresco by Gaulli "Triumph of the Name of Jesus" located in the main Roman church of the Jesuits. In spite of few observations with prices above 1,000 *scudi*, 90% of the paintings are priced less than 300 *scudi*, while the median value is 48. There are some noticeable differences between the average prices by genre. The highest values are observed for figurative paintings with historical and sacred subjects at the top followed by mythological and allegorical subjects and by battles at the bottom. Landscapes follow next, while portrait, genre paintings and still lifes are the least priced.

The range of variation by dimension is large, with very small paintings measuring less than half square meter up to the majestic "Glorification of the Reign of Pope Urban VIII", a 363 square meters ceiling fresco by Pietro da Cortona located in Barberini Palace in Rome. However, apart from few very large paintings, the average dimension is slightly more than 5 square meters while the median is just 2 square meters. Considering genres, the data show that the average dimension is between 1 and 2 square meters for all non-figurative paintings. The average dimension is instead more than 8 square meters in the case of figurative paintings.[30]

Turning to patrons, Popes accounted for about 5% of the whole demand, while around 8% came from religious institutions (excluding St Peter's church that alone covers 3.3% of the sample). The paintings were demanded mainly for private locations, particularly private collections (62%). Around one quarter of the paintings in the sample was instead addressed to churches, in same cases sponsored by private families for their own chapels inside public churches (6.7%). Demand originated mainly from Rome, but also from other important Italian towns (16%) and minor centres in the Italian countryside (8%), with large price differentials for different destinations; about 6% of the paintings were exported outside Italy.

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[30] When considering figurative paintings, an important attribute to consider is the number of figures depicted. The largest share of paintings (almost 50%) have a low number of figures (from 1 to 4), around one third have an intermediate value (between 5 and 10) while only 17% of figurative paintings contain more than 10 figures.

INSERT TABLE 3

Turning finally to painters, the original dataset contains 113 artists. The mean and median age at which paintings were done was 43 years, almost uniformly distributed among genres. More interesting evidence can actually be obtained if we look at the artists' specialization by genre in Table 3. While most artists were engaged in multiple or all kind of genres, it is important to verify to what extent this occurs for the works of our dataset. Ignoring the distinction of the figurative genre in its components (sacred, myth, history and battle), we still find 30 artists, namely 27% of the total, that painted works of different genres. For 21 of them (19% of the sample) we observe two genres. All of these painted figurative paintings in addition to another genre. Moreover, 9 artists diversified their activity in at least three genres within the dataset. The remaining artists were specialized in a single genre in the dataset, which in the large majority of cases (58) is figurative paintings in their subdivisions.[31] Finally, notice that 27 % of artists were multi-genre but this corresponds to approximately half of the total number of observations (since they have more paintings in the dataset on average) and more than half in our empirical analysis (in which we will only focus on painters with at least two observations). Of course, most of the artists may have been engaged in multiple or all genres even if this is not reported in our limited sample. All this strongly supports the fact that painters did diversify their activity.

4   Empirical strategy and results

We estimate a semi-linear price equation where the natural logarithm of price is regressed on a set of dummy variables for genres and on a set of other explanatory variables. Moreover, the PAD has a matched nature as it relates artist and patron information. This allows us to estimate the price equation including both painter and patron fixed-effects and hence to evaluate the extent to which price heterogeneity is related to unobservable characteristics among painters (artist effect) or among patrons (patron effect). Indeed, unobservable ability is in general a crucial factor of wage determination. This is all the more so in the labor market for artists, where the aesthetic value of the artwork, mainly dependent on painter's talent, is one of the key determinant of its price.

In order to include both artists and patrons fixed effects we lost from the sample all the artists and patrons with a single observation, reducing the number of observations from 1133 to 1061. Our sample then comprises a maximum of 1061 paintings for 87 artists and 50 patrons (which reduces in number depending on the explanatory variables we include due to missing

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[31]Every portraitist in the dataset did paint other genres as well, while the highest specialization is found for still lifes (11 out of 15 artists painting still lifes did not paint other genres in our dataset).

values). We should add that our panel of artists and patrons (panel over paintings, not over time for our purposes) is strongly unbalanced as it includes artists with a minimum of 2 observations and a maximum of 43 observations (Poussin) and patrons with a minimum of 2 to a maximum of 115 observations (the Chigi family).

We follow the procedure by Abowd *et al.* (1999) to analyze the compensation of the painters.[32] Specifically, we estimate the (log) price of paintings commissioned to an artist i by a patron j using OLS. We include a set of explanatory variables (i.e., paintings and artists characteristics) and both artist and patron fixed effects. The price equation we estimate is the following:

$$p_{in} = \alpha + X_{in}\beta + \theta_i + \psi_{j(i,n)} + \chi_{k(j(i,n))} + \varepsilon_{in}$$

with $E\left[\varepsilon_{in}\lfloor i, n, j(i,n), X_{in}\right] = 0$,[33] where p_{in} is the logarithm of the price paid to an artist i for a painting n, α is a constant, X_{in} denotes the observable painting-varying exogenous characteristics of both artists and of paintings (per artist) with coefficient β, θ_i is the pure artist effect, $\psi_{j(i,n)}$ is the pure patron effect for the patron $j(i,n)$ which has commissioned the painting n to the artist i, $\chi_{k(j(i,n))}$ is the effect of the genre $k(j(i,n))$ - which is related to the painting n which is commissioned to an artist i by a patron j, and ε_{in} is the statistical residual.[34]

We interpret this price equation as a wage equation in which p_{in} is the compensation of a worker i for a painting n, which is regressed on a set of observable characteristics of the painting and of the workers (experience and origin), on the identity of the individual and on the identity of the employer. The genre to which each painting belongs could also be interpreted as the

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[32]Notice that Eeckhout and Kircher (2011) have recently criticized the procedure by Abowd *et al.* (1999) to measure sorting between employers and workers, showing that in general matching models the direction of sorting depends on the cross derivative of the production function with respect to both firms and workers, whose sign is ambiguous. In our market the production function (of quality of the paintings) depends only on the workers (the artists) and not on the employers (the patrons), therefore this theoretical critique does not apply.

[33]This assumption is usually problematic in modern labor markets, because it requires exogenous mobility between jobs. When voluntary, a transition to a new job is rare and aimed at increasing the wage, and therefore it can be systematically biased by endogenous factors. This is probably not the case in our market, where painters were constantly switching from a job (and a patron) to another.

[34]After obtaining the least square parameter estimates $\hat{\beta}$, $\hat{\theta}_i$, $\hat{\psi}_j$ and $\hat{\chi}_k$ we can determine the importance of different factors in price determination with the procedure of Gruetter and Lalive (2009). Using the following decomposition of the variance of the logarithm of the price:

$$Var(p_{in}) = cov(p_{in}, X_{in}\hat{\beta}) + cov(p_{in}, \hat{\theta}_i) + cov(p_{in}, \hat{\psi}_j) + cov(p_{in}, \hat{\chi}_k) + cov(p_{in}, \hat{\varepsilon}_{in})$$

we can express the importance of each factor as the ratio between the covariance of its contribution with the price and the overall variance. In particular, the importance of the artists effects is:

$$v_\theta = \frac{cov(p_{in}, \hat{\theta}_i)}{Var(p_{in})} = \frac{Var(p_{in}, \hat{\theta}_i) + cov(X_{in}\hat{\beta} + \hat{\psi}_j + \hat{\chi}_k, \hat{\theta}_i)}{Var(p_{in})}$$

and the same for the other components. Notice that $cov(\hat{\psi}_j, \hat{\theta}_i) > 0$ implies positive sorting between artists and patrons effects, and $cov(\hat{\psi}_j, \hat{\theta}_i) < 0$ implies negative sorting.

industry to which each artist belongs. This enables us to interpret mobility of artists across artistic sectors as inter-industry workers mobility and prices differentials across genres as inter-industry wage (compensation) differentials. One important difference, however, is that while each firm could be classified into a single industry, here each patron could commission paintings belonging to different genres.

4.1 Main results

Our results are summarized in Table 4. In the first column we start by estimating a baseline price equation where the natural logarithm of price is regressed on dummies for genres in order to highlight the unconditional price differential between them. As already shown by descriptive evidence, a sharp ranking of prices can be detected, with still lifes (the reference category) at the bottom, followed in increasing order by portraits and genre paintings, and by landscapes and battles. Figurative paintings are the best paid artworks, with sacred and mythological subjects with a large number of human figures at the top. We also performed pairwise t test on the equality of coefficients between still lifes, portraits, genre paintings, landscapes and figurative paintings and we found that they were all statistically different from each other with the only exception of the coefficients of genre paintings and portraits. This result is in line with the traditional hierarchy of genres (and with the anecdotal evidence according to which the relative position of portraits in this hierarchy was variable).[35] Overall, differences in genre and number of figures appear to explain only 42% of price variability.

The descriptive analysis has shown a large variation of paintings' size by subject. More specifically, figurative paintings have a higher average dimension than other subject paintings. Related studies on the value of old master paintings in the rest of Italy show that dimension was a crucial determinant of prices (see Etro and Pagani, 2012). Hence, we firstly want to see whether the price differential between genres persists after controlling for paintings' dimension. The second column shows that indeed it does, confirming the price differential between genres per square meter, though the relative price premium diminishes for figurative paintings with a large number of figures.[36]

INSERT TABLE 4

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[35] See Spear and Sohm (2010). Incidentally, this result is also consistent with the descriptive evidence reported in Table 2, where slightly increasing the number of observations is enough to invert the rank between genre and portrait with respect to the one emerging from the baseline regression. Notice that historical subjects and battles appear to be less paid than other figurative subjects, at least in compositions with a large number of figures. Also this is in line with the hierarchy of genres, since idealized subjects (as religious and mythological subjects) were better considered than realistic (historical) ones.

[36] Standard variance decomposition shows that the contribution of genre differentials to explain price variability is still 34% against 14% of size.

As the following step, in the third column, we control for the full set of paintings' characteristics. Results show that the price differential still exist, although it is reduced: paintings with the same objective characteristics are differently paid depending on the subject they represent. Prices decrease with the number of commissioned paintings and in the case of oil paintings that are not painted on canvases, even though only at the 10% level of significance; the coefficients for the dummies for copies and frescoes are negative as well. To control for demand effects, in this specification we also include the geographical destination for which the painting was demanded and the location where it was planned to be positioned. Quite interestingly, and in line with the common perception at the time, paintings addressed abroad were the most paid, about 120% more than our reference destination, which is Rome, while paintings commissioned for the countryside were paid about 50% less. As the location destination is concerned, we can detect a clear ranking where commissions for private chapels were by far the best paid, those for churches were "intermediate", and those for private palaces and private collections (the reference category) were at the bottom. Finally, in this specification we introduce two macroeconomic explanatory variables. The first is the time trend in paintings' prices, which emphasizes a negative but extremely small trend. The second is a dummy for the decade following the plague of 1656, which is meant to capture the effect of the main aggregate shock which may have affected demand (but also supply) during the century: the effect is not significant. Both these controls will be omitted in the following specifications, because the year of execution co-move with the age of the artists and because of the irrelevance of the aggregate shock.[37]

We then add in the fourth column the artist observable characteristics, including the age of the artists and a dummy for immigrant painters. The price of paintings increases with artist's age by around 2% per year, in line with what found by Etro and Pagani (2012) for Venetian paintings in the same period. Concerning the provenance of the painters, notice that foreign painters were mainly specialized in minor genres, which were less paid in absolute terms. However, when controlling for genres, we do not find any evidence of price differentials between Italian and immigrant painters.[38] After controlling for all the observable characteristics of paintings and painters (in our possession), the decomposition of the variance of prices shows that the contribution of genre differentials is still of 30% against 35% for the all the other observable characteristics.

In the fifth column we enrich the specification by simply adding patron fixed effects in order to control for unobservable heterogeneity on the demand side. Results show that the

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[37]Controlling for age, the time trend becomes indeed irrelevant. And our main results remain the same if we replace age with the year of execution in the full specification. We used also ten or twenty year dummy variables to control for time effects, without changing the basic results.

[38]Results will not be displayed in the full specification due to collinearity with the artists fixed effects.

price differential between genres still persists, although it is slightly reduced: each patron did pay on average much more for a figurative painting compared to another painting of the same size and characteristics but of a different genre, exactly because the willingness to pay for different genres was variable according to the hierarchy of preferences for different genres in the Baroque age. Notice, however, that after controlling for patron fixed effects the coefficients of the geographical destinations become non-significant at conventional levels, suggesting the existence of an arbitrage mechanism between destinations with different demand - as already pointed out in Etro and Pagani (2012) for the Venetian market.

Including only artist fixed effects, in the sixth column, strongly reduces the price differentials between genres and those coefficients became almost all insignificant, with the exception of all the coefficients on figurative paintings. We should emphasize that the value of the (non-adjusted) R squared is higher in this specification which contains only artist fixed effects (i.e., 0.80) with respect to the previous one where we included only patron fixed effects (0.77).

Estimation results of the full model of our price equation are presented in the last column of Table 4. This specification includes both patrons and artists fixed-effect (i.e., their unobservable characteristics to control for individual talent). The price differential between still lifes and all the other genres finally disappears: *ceteris paribus*, a still life was not paid differently from a portrait, a genre painting, a landscape or a figurative painting (with less than five figures) by the same painter. Moreover, notice that also any price differential between figurative paintings (namely of historical, mythological and sacred subject) with a similar number of figures disappears. This is true for all the three groups of figurative paintings, that is with less than five figures, with five to ten figures and with a crowd or more than ten figures (which includes also all the battles). Therefore, our main hypothesis is fully confirmed: the artistic sector choice of painters led to the equalization of prices. In a sense, if figurative paintings were paid more in absolute terms, it was mainly because better painters were engaged in figurative paintings. On the other side, minor painters could not switch from still lifes to figurative paintings to earn extra profits because they would have been paid less than other painters, exactly enough to make them indifferent between genres. Which is exactly what a competitive labor market would have predicted. Notice that a similar result concerns geographical destinations, whose coefficients are non-significant: arbitrage appears to take place both across sectors (genres) and between commissions from major destinations and the countryside.

In Table 5 we report the contributions of artists (fixed effects and age), patrons, genres (including figuratives with less than five figures, that are comparable with the other genres) and other observable characteristics to explain the variance of logprices (as in Gruetter and

Lalive, 2009) after estimation of the full specification in the last column of Table 4. Pure price differentials between genres provide a negligible contribution to explain overall price variability (2.15%), while all the observable characteristics together explain almost 42% of it, and artist and patron effects together explain more than 43%, with a larger role for artists than patrons. These results appear in line with those of Abowd *et al.* (1999) and the subsequent literature, which shows that most of the inter-industry wage differentials can be explained by variation in unobservable characteristics, mainly of the workers.

At this stage of the analysis we can comment also on the other final estimation results. Starting from the effect of paintings' characteristics, we confirm previous results regarding the positive link between size and price, with a return above 3% for an additional square meter beyond the average size; moreover, we find evidence of decreasing returns given the negative and significant coefficient of the squared term. The price premium for figurative paintings with a large number of human figures remains positive and it is statistically significant: plus 91% for figurative paintings with five to ten figure and plus 118% for those with more than ten figures.[39] This is consistent with our hypothesis that quantifiable aspects of paintings as the number of figures depicted were agreed (in preliminary drawings or verbal communications, as we know it happened for Guercino, Guido Reni and others) also with the purpose of insuring a certain effort and quality, a sort of incentive mechanism to limit moral hazard in line with standard principal-agent theory (Holmstrom and Milgrom, 1991).[40]

The dummy on frescoes is negative and significant: this suggests that the rapid technique of frescoes, often executed by high quality painters, was compensated with a lower payment per square meter. Nevertheless, in the absence of further information on the time of execution of frescoes, as compared to oil paintings, we cannot draw definitive conclusions on the existence of price differentials between the two techniques. The coefficients for copies and for paintings not on canvas are negative and significant in specifications not controlling for artists' characteristics, while in the full specification they remain negative but they turn insignificant. Therefore, copies (or replicas of existing paintings) and paintings on copper and other unusual supports were not paid less, but they were simply done by worse painters: again, there was nothing to gain in specializing in copies or in paintings on a different support, otherwise a profitable opportunity

[39] We remark that the price premium for figurative paintings with a small number of figures would have not only been statistically insignificant, but also economically insignificant, had we limited the category to a lower number of figures (up to two or three). We are grateful to Deirdre McCloskey for discussion on this point.

[40] This hypothesis needs further verification. The price premium for number of figures is confirmed in a wider dataset with only figurative paintings. Most important, it disappears for the subset of figurative paintings whose price was estimated *ex post*. This may confirm that a price premium emerges only in *ex ante* contracts as a partial solution to the moral hazard problem. We are grateful to Paul Milgrom and Julio Rotemberg for lively discussions on this point.

would have emerged. Finally, the negative coefficient of the variable describing the number of paintings in the multiple commissions highlights the existence of a quantity discount of around 5% for each additional painting.

On the demand side, interesting results concern the impact of the place where the artwork was addressed to. As a matter of fact, the same patron could have different willingness to pay depending on the place where the painting was planned to be positioned. For instance, patrons often commissioned paintings for their private chapels within public churches. Nelson and Zeckhauser (2008) have suggested that higher investments for these commissions could be motivated to induce higher quality and signal more magnificence in front of the contemporaries. Our estimates largely confirm this hypothesis: the very high and significant coefficient for the commissions for private chapels implies that they were on average more paid than paintings for private collections (the excluded category) and private palaces (however, the coefficient of private chapel is higher but not significantly different from that of other religious destinations).

INSERT TABLE 4 (cont'd) (artist)

INSERT TABLE 4 (cont'd) (patron)

4.2 Artist and patron effects

Let us consider to the role of painters' and patrons' characteristics in our full specification. The price of paintings increases with artist's age by around 2% per year which may be related to the importance of on-the-job experience in a Mincerian style or in terms of experimental innovativeness (Galenson, 2006; Galenson and Weinberg, 2000). Due to the unbalanced nature of our panel, in Table 4, we report only the coefficients of the artists with at least eight observations, since for too few observations it would be difficult to comment on the values of their coefficients. In order to facilitate interpretation, we follow the technique used by Krueger and Summers (1988) to compute industry wage differentials with the method of correction proposed by Haisken-DeNew and Schmidt (1997) to compute the exact standard errors of coefficients, and we express results as deviation from an artist-share weighted mean. The coefficients on the artist dummy variables then show the artist effect with respect to the sample average. Results show that some of the most famous painters of the time were the best paid: first of all the main masters of the typical Baroque art such as Guido Reni, Pietro da Cortona and Carlo Maratta (in ascending order), often engaged in figurative paintings, but also painters that were repeatedly active in multiple genres such as Caravaggio, who was actually responsible for the introduction of genre paintings and still lifes in Italian art, or the French painter Simon Vouet. Between the best paid painters we also find two other French painters, Nicolas Poussin and Claude Lorrain, who were

mainly engaged in landscapes.

INSERT TABLE 5

Let us move to the patrons. As expected, patrons' characteristics also affect prices. As we did for the artists, in Table 4 we report the coefficients of the patrons with at least eight observations in the estimation sample, relative to the average patron. We see that paintings commissioned by the Vatican St Peter's church, by foreign kings and by selected wealthy and powerful families outside Rome, such as the Medici from Florence and the Gonzaga from Mantua were paid more than average. Instead, some established families based in Rome such as the Orsini and the Sacchetti paid less than average (also Barberini, Borghese and the Popes have negative, though not significant at conventional levels, coefficients). Interpreting these results from a labor market perspective, however, is not immediate.[41]

Two main explanations may lie behind higher prices paid by specific patrons: compensating wage differentials and efficiency wages.[42] As we argued before, compensating wage differentials are consistent with a competitive labor market (e.g., see Hwang *et al.*, 1992). Working for some specific patrons provided artists with alternative types of compensation: examples were the opportunity to access to prestigious networks that provided repeated commissions and so to see an increase in their future earning profile or at least to reduce their risk in the process of gaining new commissions. This would generate lower prices for well connected Roman families and higher prices for foreign families, and also negative sorting: better painters should prefer the safer commissions.[43] The other possibility is that the labor market was not competitive and frictions due to imperfect observability of quality and effort led to efficiency wage mechanisms aimed at selecting quality (Weiss, 1980) or inducing effort (Shapiro and Stiglitz, 1984). However, these mechanisms would imply positive sorting because patrons should pay more to select higher quality painters or to induce higher effort.

In Table 5 we provide some preliminary attempt at disentangling alternative interpretations looking at the decomposition of the variance of prices, as done in Gruetter and Lalive (2009).

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[41] Notice that the demand for paintings expressed by the patrons (contrary to firms) is a demand for consumption and not for production and so, in our setting, an explanation for the existence of a price difference at the employer level, might depend on some limited capacity at the patron level. Nevertheless, paintings at that time should not be classified strictly as consumer durable goods but they were also a signal of the patron's status ("magnificence"). To some extent, religious paintings also represented a form of intertemporal substitution between present and future consumption (if we interpret them as a tribute to God and thus as an instrument to produce an access to perpetual life).

[42] Another traditional explanation in modern labor markets has to do with the role of unions. Our painters did belong to a guild, but this was not able to affect prices in any effective way (Spear and Sohm, 2010).

[43] A related point is that the observed cross-patrons price differentials may reflect unobserved characteristics of the artist-patron match indicating relative bargaining power. In the next section we replicate estimation including match-specific fixed-effects.

The variance-covariance matrix shows the determinants of the contribution of different effects in explaining price variability. For instance, most of the contribution of the artists derives from the variability between artists, but also from the fact that better paid artists were engaged in commissions with observable characteristics that were better paid, such as larger paintings for private chapels. If we look at the contribution of patrons, we notice a high variability in their payments and again a positive covariance with the observable characteristics: patrons that paid more also asked more valuable characteristics, as it should be intuitive. More intriguing is the relation between patron and artist effects. Here we find some evidence of *negative sorting*: better paying patrons tended to match with less paid artists. This can lead to some speculation on the role of patrons in setting prices, because negative sorting is consistent with the hypothesis of compensating wage differentials but not with efficiency wages.[44] A closer look at the evidence then supports the idea that a competitive mechanism could explain the few residual price differentials consistently with a competitive labor market.[45]

4.3 Robustness checks

We performed a number of robustness checks on our basic empirical analysis, the main two will be discussed in this and in the following section.[46] Ideally, one would have liked to observe a dataset in which all patrons demand paintings of all genres to each artist, which is clearly impossible within a limited historical sample as ours. However, it is interesting to check whether price equalization holds where the artists or the patrons are indeed diversifying their supply or their demand. In the first column of Table 6 we present the results of a regression in which we limited the data to the paintings of the "switchers", that is the painters that in the dataset have paintings in more than one genre. In fact, if all artists were strictly specialized in a single genre, by simply adding a dummy for each artist to the dummies for genres would explain why the

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[44]Incidentally, the relevance of compensating wage differentials emerges also in the investigation of Gruetter and Lalive (2009) on the Austrian labor markets. Card *et al.* (2012), however, find positive sorting in the German labor market.

[45]Extremely rich and powerful foreign patrons, as foreign kings, the Medici and the Gonzaga did have to pay a lot to obtain works from artists active in Rome, but rarely from the very top ones. The less famous Nolfi family had to pay a lot to convince Domenichino to move to Fano and decorate a private chapel with frescoes. Instead, some important Roman families such as Orsini and Sacchetti managed to purchase repeatedly from top painters at good prices. Remarkably, the only art dealer in the dataset, Capocaccia, has a negative coefficient: probably it was for his services to the painters as a distributor of paintings across Roman families that he managed to obtain good deals from the best painters. Only the exceptional prices for the decoration of St. Peter's church do not appear in line with the hypothesis of compensating wage differentials, but this case is unique under many dimensions.

[46]In unreported regressions we also excluded outliers (in particular paintings with extremely high price or size), frescoes and paintings on a different support than the most common canvas, we extended the dataset to the period 1576-1711 and we controlled for the evolution of the artist fixed effects with age. Regressions available from the authors confirm our main results.

inter-genre price differential goes away. To the contrary, the main assumption underlying our result is that the painters, or some of them, could switch their activity between different genres to exploit any profitable opportunities, which implies that such opportunities should disappear in equilibrium. An immediate implication of this is that price equalization should strictly hold for all the painters that do diversify within our dataset.[47] The results presented in Table 6 on the switchers reinforce our main conclusion regarding the validity of the hypothesis of price equalization between genres.

INSERT TABLE 6

In the second column of Table 6 we present the results of a regression in which we limited the data to observations referring to patrons that demanded paintings of different genres. After this selection, the number of observations is largely reduced, but the main results are confirmed. This check can provide additional insights on the competition mechanism at work: we find again that there are no price differentials between genres, suggesting the existence of competition between artists also within commissions from specific patrons.

Finally, we estimate the model including match-specific fixed-effects in order to control for unobserved characteristics of the artist-patron match, such as relative bargaining power. Woodcock (2011) presents direct evidence on the US of the importance of matching in wage determination. He finds that match effects, which have been ignored in previous works, are an important determinant of earnings dispersion, and concludes that specifications that omit match effects substantially over-estimate the returns to experience, attribute too much variation to personal heterogeneity, and underestimate the extent to which good workers sort into employment at good firms. In our dataset we can identify match effects only for observations referring to artists and patrons with more than a single transaction and with relationships with, respectively, more than one patron and more than one artist, because otherwise the match fixed-effects could not be identified. We are able to identify 64 matches between a corresponding number of artists and patrons, amounting to 249 observations. Despite we cannot include match effects for all the sample's observations, we replicate estimates inserting match specific fixed-effects in the equation to be estimated; results are largely unchanged and they confirm our main conclusion regarding price equalization (see column 3 of Table 6).

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[47]Incidentally, we know that most of the painters who have a single genre in the dataset did paint also other genres (not in the dataset), therefore the set of the "switchers" is in principle larger than the one we have.

4.4 Hedonic regressions

A final test of our hypothesis of price equalization between genres requires us to identify the source of this equalization. We already argued that the hierarchy of genres justifies different willingness to pay by patrons for different genres: in particular, the willingness to pay for a square meter of canvas by a representative patron shifts up or down depending on the subject. Accordingly, it must be the supply side to determine price equalization: each painter is willing to accept the same compensation for a square meter of canvas independent from its subject (otherwise there would not be incentives to switch between different genres and painters would fully specialize). To verify this we need to identify separately the willingness to pay of the patrons and the offer price of the painters for a square meter of painting. For this purpose, we have applied the methodology pioneered by Rosen (1974) for estimating demand and supply parameters in hedonic regressions, that is price or wage regressions that take into account measurable characteristics of a good, such as the size of a painting.[48]

The Rosen methodology involves a two-step procedure. In the first stage, paintings prices (in levels) are regressed on paintings characteristics independent from demand and supply characteristics. In our case, these attributes are size (entered also with quadratic and cubic terms in order to impose a more flexible specification), three dummy variables for copy, fresco and type of support, and the full set of genre dummy variables interacted with the number of figures in the case of figurative paintings. Then, the implicit market prices for these characteristics for each painter and patron can be computed as the derivative of the fitted price with respect to the specific characteristics. In the second stage, a simultaneous system of supply and demand equations for each characteristic is estimated, including in the supply/demand curves exogenous shifters that allow identification.[49] A *3SLS* estimation method was used in order to take into account that structural disturbances have non-zero covariances.

Rosen's approach has been greatly criticized and many different alternatives have been suggested.[50] The main problem with this type of estimates relates to sorting or endogenous matching between employer and workers. A typical solution was using information coming form

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[48]Rosen's approach has been widely used in the literatures on housing, public economics, environmental economics, industrial organization and labor markets. Our empirical model is in many respects similar to an hedonic pricing model where heterogeneous workers are assigned to heterogeneous jobs choosing the optimal amount of "job complexity" (e.g., see Brandt and Hosios, 1996; Teulings, 1995; Ekeland *et. al.* 2004).

[49]In our case, these are artist fixed-effects and the age of artists in the offer curve and patron fixed-effects, a set of dummies for the location, a set of dummies for the city destination and a dummy variable for multiple commission in the bid curve.

[50]In a competitive environment, see, among others, Epple (1987), Kahn and Lang (1988) and Ekeland *et al.* (2004). For extensions to imperfect competition see, among others, Goldberg (1995).

different geographical or temporal markets.[51] The multimarket (or multi art-sector in our case) approach, however, proves to be difficult to be applied to our context. The first reason is that some of the fundamental characteristics of either the employer or the workers (or both) might be "endogenous" to the market the actors are in; in other words, tastes cannot assumed to be the same over art sectors. Second, we would need to assume that markets are as isolated as possible: while we are allowing a painter to match with patrons within a market endogenously, we should assume that the market the painter is in is exogenous, which would actually go in the opposite direction of what we are trying to show, namely that painters can freely move to markets in which payoffs to their "characteristics" are high. By the use of panel data, however, we should address the potential "two-sided" matching problem in our data, where unobserved patron characteristics may be correlated with observed painter characteristics and unobserved painter characteristics may be correlated with observed patron characteristics. If the same patron contracts with multiple painters (and *vice versa*), as in our sample, and unobserved characteristics are constant across these contracts, panel techniques should eliminate the endogeneity problem.[52]

INSERT TABLE 7

Since we are interested in testing the robustness of the price equalization hypothesis, in Table 7 we show second stage results regarding bid and offer price only for size, that can be interpreted as the "unitary" painting's price (the coefficients must be read in terms of silver *scudi* per a square meter of painting). The price-equalization between genres hypothesis appears to be confirmed by the offer curve estimation results: painters were willing to offer a square meter of paintings of different genres at the same price (we also find positive and significant coefficients of the figure-genre interactions coefficients, suggesting that painters required a higher price to offer paintings with more figures probably due to higher costs). The estimation of the bid function instead reveals differentiated reservation prices for the different genres and the result appear in line with the traditional hierarchy of genres. Although non-significant, the coefficient of portrait is the lowest after the omitted still lifes, immediately followed by the coefficient for genre paintings. The coefficient of landscape follows next, and in this case it is statistically significant, highlighting the higher willingness to pay for this kind of painting. As was expected, the highest bid price is found for figurative paintings. Finally, also in the demand case we see that patrons were more willing to pay for paintings with more figures. All this supports the hypothesis that the willingness to pay for paintings of different genres was indeed ranked according to the hierarchy of genres associated with the culture of the time, but competition

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[51]In the case of many markets the different markets will have different distribution of consumers and firms affecting the matching process without affecting the demand and supply equation (then the marginal price will differ for the different markets).

[52]See Ackerberg and Botticini (2002).

between painters led them to supply different genres at comparable prices, so as to eliminate price differentials in equilibrium.

5 Conclusions

We analyzed the labor market in the Baroque Roman art sector using a unique matched painter-patron panel dataset on commissions for still lifes, landscapes, portraits, genre paintings, battles and sacred, mythological and historical paintings. In line with the traditional hierarchy of genres, the price differential between them was high and significant. Adopting a labor economics perspective we were able to analyze the inter-industry (genre) compensation differentials taking into account the role of individual and employer heterogeneity in the determination of workers' compensation. We found that most of the inter-genre price differential is explained by the variation in average individual heterogeneity across sectors (genres). This suggests that the labor market for painters was rather competitive at the industry level and allocated artists between artistic genres to the point of equalizing the marginal return of different genres. For each painter, every commission from a patron for a still life, a portrait, a genre painting, a landscape or a comparable figurative painting was equally profitable at the margin. This reflected an efficient equilibrium of occupational choice and, incidentally, made it possible for the new artistic genres to develop and flourish in this and the following centuries. These results are confirmed by an hedonic price specification in which we identified separately the willingness to pay of the patrons and the offer price of the painters for a square meter of painting.

Additional data on other paintings, patrons and artists may allow one to improve our main empirical analysis, to check how the artist fixed effects evolve with the sales price of previous works and with the sponsorship of nobles, to check for the relevance of network relations between artists and patrons and may also allow one to make further progress in the identification of demand and supply of art. Finally, in a Schumpeterian perspective, it would be interesting to investigate whether different compensations affected artistic innovations in certain locations or certain periods of art history: it was not by chance that artistic innovation flourished first in the wealthiest cities characterized by more developed free market economies, as was Rome during the XVII century.

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Table 1: typical record in PAD

PI Record	No.P-264
Artist Name	CARAVAGGIO, MICHELANGELO MERISI DA
Title	Martyrdom of St. Matthew; Calling St. Matthew
Subject	Sacred
Object Type	Oil (chapel laterals)
Dimensions	322 x 343 cm; 323 x 340 cm
Figures	5-10; crowd
Patron Name	Estate of Cointrel, Mathieu, Cardinal
Payment Date	1599-1600
Price Paid	400 scudi for two paintings
City (Destination)	Rome, S. Luigi dei Francesi, Contarelli chapel

Table 2: Descriptive Statistics of the original Dataset (1133 obs)

			Genre distribution (%)				
Still	Portrait	Genre	Landscape	Battle	Myth	Sacred	History
9	9	3	21	3	7	45	3

			Average price by genre (in scudi romani)				
Still	Portrait	Genre	Landscape	Battle	Myth	Sacred	History
17	39	25	66	73	202	242	262

			Average size by genre (in square meters)				
Still	Portrait	Genre	Landscape	Battle	Myth	Sacred	History
1.1	1.9	1.4	1.9	1.5	15.3	7.3	11.5

Number of figures distribution (%)		
Low (1-4)	Medium (5-10)	High (crowd)
49	33	17

Object type distribution (%)		
Not on canvas support	Fresco	Copy
6	7	3

			Patrons (%)			
Rel other	King	Foreign nob	St Peter	Pope	Church	Private families
0.7	1	2	3.3	5	7	81

Location Destination (%)			
Private chapel	Private palace	Church	Private collection
6.7	12	19	62

City destination (%)			
Foreign	Rome	Medium	Minor
6	70	16	8

Average price by destination (in scudi romani)			
Foreign	Rome	Medium	Minor
238	146	137	127

Table 3: Artist Specialization by Genre

	Number of genres			
	1	2	3	Total
No. of artist	83	21	9	113
of which:				
Stilllife	11	1	3	15
Genre	3	2	4	9
Landscape	11	5	6	22
Portrait	0	13	5	18
Figurative	58	21	9	88
% observations	53	26	21	100

Table 4: Log Price determination

	Baseline	Baseline with size	With paintings characterstics	With artist characterstics	With only patron FE	With only artist FE	With patron & artist FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Still life (omitted)							
Portrait	0.631***	0.592***	0.530***	0.726***	0.596***	-0.283	-0.349
	(0.154)	(0.152)	(0.141)	(0.145)	(0.153)	(0.377)	(0.397)
Genre	0.674***	0.668***	0.591***	0.518**	0.437**	0.002	-0.030
	(0.210)	(0.205)	(0.202)	(0.232)	(0.220)	(0.399)	(0.405)
Landscape	1.383***	1.338***	1.092***	1.098***	0.864***	0.062	0.308
	(0.143)	(0.142)	(0.138)	(0.151)	(0.180)	(0.395)	(0.440)
Figurative (< 5 fig)	1.901***	1.770***	1.360***	1.468***	1.268***	0.588*	0.534
	(0.143)	(0.145)	(0.153)	(0.150)	(0.172)	(0.349)	(0.369)
Sacred < 5 (omitted)							
History < 5	0.090	0.129	0.086	0.011	0.019	-0.240	0.003
	(0.169)	(0.145)	(0.223)	(0.241)	(0.186)	(0.291)	(0.265)
Myth < 5	-0.211	-0.193	0.040	-0.020	0.072	-0.018	0.100
	(0.163)	(0.157)	(0.188)	(0.185)	(0.195)	(0.198)	(0.204)
Figurative (5-10 fig)	2.886***	2.572***	1.934***	1.994***	1.636***	1.100***	0.912**
	(0.148)	(0.149)	(0.158)	(0.155)	(0.177)	(0.352)	(0.371)
Sacred 5-10 (omitted)							
History 5-10	-0.716***	-0.506**	-0.107	0.001	0.009	-0.111	0.004
	(0.223)	(0.230)	(0.242)	(0.197)	(0.226)	(0.179)	(0.205)
Myth 5-10	-0.154	0.011	-0.010	-0.037	-0.243	-0.042	-0.354
	(0.422)	(0.404)	(0.368)	(0.345)	(0.282)	(0.299)	(0.285)
Figurative (>10 fig)	3.439***	2.586***	2.045***	2.304***	1.858***	1.365***	1.183***
	(0.244)	(0.239)	(0.223)	(0.219)	(0.230)	(0.389)	(0.421)
Sacred >10 (omitted)							
History >10	-1.192***	-0.506	-0.113	-0.264	-0.175	-0.121	-0.000
	(0.403)	(0.386)	(0.290)	(0.323)	(0.243)	(0.448)	(0.537)
Myth >10	0.124	-0.249	0.407	0.173	0.380	0.231	0.413
	(0.352)	(0.314)	(0.304)	(0.296)	(0.334)	(0.371)	(0.357)
Battle >10	-2.169***	-1.334***	-0.822**	-1.057***	-0.941***	-0.123	-0.282
	(0.349)	(0.338)		(0.337)	(0.252)	(0.361)	(0.336)
Size		0.053***	0.044***	0.039***	0.034***	0.037***	0.032***
		(0.009)	(0.008)	(0.009)	(0.007)	(0.010)	(0.010)
Size^2		-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
# commissions			-0.016*	-0.026***	-0.099***	0.005	-0.049**
			(0.009)	(0.009)	(0.019)	(0.009)	(0.024)
Copy			-0.556**	-0.797***	-0.996***	0.024	-0.177
			(0.234)	(0.278)	(0.225)	(0.287)	(0.221)
Not on canvas			-0.284*	-0.309**	-0.435***	-0.201	-0.280
			(0.156)	(0.151)	(0.153)	(0.201)	(0.203)
Fresco			-0.213	-0.087	-0.472**	-0.218	-0.396**
			(0.153)	(0.162)	(0.204)	(0.195)	(0.193)
Private chapel			1.517***	1.697***	0.797***	1.112***	0.686**
			(0.181)	(0.180)	(0.240)	(0.169)	(0.302)
Church and other rel			0.855***	0.851***	0.514***	0.846***	0.645***
			(0.130)	(0.127)	(0.159)	(0.134)	(0.153)

Table 4 (cont'd): Log Price determination

	Baseline	Baseline with size	With paintings characterstics	With artist characterstics	With only patron FE	With only artist FE	With patron & artist FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Private palace			0.294**	0.429***	0.287	0.331**	0.557***
			(0.135)	(0.143)	(0.182)	(0.130)	(0.174)
Private collection (omitted)							
Minor destinations			-0.492***	-0.432***	-0.105	-0.151	0.109
			(0.148)	(0.148)	(0.220)	(0.168)	(0.209)
Medium destinations			0.474***	0.445***	0.215	0.279**	0.023
			(0.110)	(0.111)	(0.208)	(0.115)	(0.164)
Exports			1.163***	0.868***	0.328	0.544***	0.286
			(0.156)	(0.168)	(0.271)	(0.209)	(0.218)
Rome (omitted)							
Age of artist				0.021***	0.018***	0.016***	0.018***
				(0.003)	(0.003)	(0.005)	(0.005)
Immigrant				-0.069	0.117		
				(0.106)	(0.118)		
Trend			-0.006***				
			(0.002)				
Plague			0.147				
			(0.108)				
Constant	2.204***	2.145***	12.503***	1.270***	1.136***	-0.142	-1.742***
	(0.116)	(0.114)	(2.774)	(0.192)	(0.258)	(0.159)	(0.613)
Artist fixed-effects	NO	NO	NO	NO	NO	YES	YES
Patron fixed-effects	NO	NO	NO	NO	YES	NO	YES
Observations	867	831	732	732	732	732	732
R-squared	0.419	0.477	0.631	0.648	0.765	0.795	0.852

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4 (cont'd): Log Price determination[a]

Patron with at least 8 obs. in the est. sample

Aldobrandini	-0.332	Mazarin	-0.670**
	(0.309)		(0.308)
Altemps	-0.419	Medici	0.830***
	(0.540)		(0.252)
Barberini	-0.149	Nolfi	1.702***
	(0.120)		(0.467)
Borghese	-0.011	Orsini	-1.426***
	(0.236)		(0.336)
Capocaccia	-0.878***	Peretti montalto	0.201
	(0.339)		(0.233)
Chigi	0.044	Pointel	-0.419
	(0.146)		(0.400)
Church	0.029	*Pope*	-0.216
	(0.182)		(0.176)
Colonna	-0.005	Roscioli	-0.637***
	(0.239)		(0.204)
Filomarino	-1.604***	Ruffo	0.059
	(0.393)		(0.252)
Foreign nobles	0.188	Sacchetti	-2.136***
	(0.226)		(0.369)
Gonzaga	1.640**	*Vatican St. Peter*	0.777***
	(0.700)		(0.204)
King	1.367***	Valguarnera	-0.058
	(0.400)		(0.319)
Mattei	-0.241		
	(0.343)		
Artist fixed-effects	YES		
Patron fixed-effects	YES		

Robust standard error in parentheses *** p<0.01, ** p<0.05, * p<0.1

a: Coefficients represent deviations from patron-share weighted mean. Specification as in column 7 of Table 4.

Table 4 (cont'd) : Log Price determination[a]

Artists with at least 8 obs. in the est. sample

Arpino	0.167	Lanfranco	0.473**
	(0.290)		(0.214)
Baglione	-0.017	Leoni	0.929
	(0.349)		(0.567)
Belloni	-0.943***	Lorrain	0.837***
	(0.329)		(0.252)
Both	0.344	Maratti	1.070***
	(0.310)		(0.197)
Bril	-0.594*	Mattia Preti	-0.475**
	(0.335)		(0.233)
Camassei	-0.054	Mei	0.325
	(0.342)		(0.203)
Caravaggio	0.791**	Morandi	-0.019
	(0.335)		(0.227)
Cerquozzi	0.002	Nuzzi	-0.723***
	(0.431)		(0.271)
Courtois	-0.711**	Pace	-0.411
	(0.340)		(0.394)
Cortona	0.859***	Poussin	0.671**
	(0.221)		(0.293)
V. de Boulogne	0.421	Reni	0.650**
	(0.315)		(0.254)
Domenichino	0.092	G. Romanelli	0.360
	(0.185)		(0.221)
Dughet	-0.534	Rosa	0.652
	(0.328)		(0.412)
Ferri	0.243	G. Sacchi	0.559**
	(0.206)		(0.217)
F. Napoletano	0.012	Salini	-1.386***
	(0.305)		(0.473)
Gaulli	0.209	Stanchi	0.154
	(0.242)		(0.408)
Gimignani	-0.316*	Tempesta	-0.567*
	(0.174)		(0.311)
Grimaldi	0.259	Vouet	0.866**
	(0.322)		(0.401)
Jannetti	-2.054***		
	(0.495)		
Artist fixed-effects	YES		
Patron fixed-effects	YES		

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

a: Coefficients represent deviations from artist-share weighted mean. Specification as in column 7 of Table 4.

Table 5: The components of paintings' prices

	Total contribution	Observable characteristics	Artist effect	Patron effect	Error term
Observable characteristics	41.95	32.82	6.21	2.92	0.00
of which genre effect	2.15	-	-	-	-
Artist effect	23.67	6.21	22.68	-5.22	0.00
Patron effect	19.58	2.92	-5.22	21.89	0.00
Error term	14.79	0.00	0.00	0.00	14.79
Total contribution	100.00	41.95	23.67	19.58	14.79

Table 6: Robustness checks

	Only multi-genre artist	Only multi-genre patrons	Matched fixed-effects[a]
Still life (omitted)			
Portrait	-0.100	0.192	-0.587
	(0.451)	(0.487)	(0.497)
Genre	0.266	0.199	-0.090
	(0.453)	(0.328)	(0.297)
Landscape	0.536	0.590	0.283
	(0.489)	(0.451)	(0.521)
Figurative (<5 fig)	0.647	0.496	0.501
	(0.453)	(0.449)	(0.455)
Sacred <5 (omitted)			
History <5	-0.512	-0.022	0.094
	(0.445)	(0.393)	(0.206)
Myth <5	0.225	0.357	0.222
	(0.319)	(0.223)	(0.198)
Figurative (5-10 fig)	1.259***	1.142**	0.911**
	(0.475)	(0.525)	(0.451)
Sacred 5-10 (omitted)			
History 5-10	0.093	0.359	0.320
	(0.337)	(0.357)	(0.232)
Myth 5-10	-0.562	-0.113	-0.454
	(0.457)	(0.469)	(0.317)
Figurative (>10 fig)	1.330**	1.236**	1.130**
	(0.534)	(0.481)	(0.473)
Sacred >10 (omitted)			
History >10	-0.122	-1.098**	0.036
	(0.762)	(0.486)	(0.649)
Myth >10	0.660	0.174	0.655*
	(0.440)	(0.501)	(0.341)
Battle >10	-0.616	-1.014***	-0.188
	(0.482)	(0.368)	(0.329)
Constant	2.129**	-1.392**	-2.190***
	(0.861)	(0.658)	(0.779)
Other controls	YES	YES	YES
Observations	359	160	732
R-squared	0.858	0.901	0.897

Robust standard error in parentes *** p<0.01, ** p<0.05, * p<0.1

a. Specification as in column 7 of Table 4 adding match-specific fixed-effects.

Table 7: Two-stage hedonic estimation

	Offer price for size	Bid price for size
	(1)	(2)
Still life (omitted)		
Portrait	0.150	0.786
	(2.500)	(1.464)
Genre	0.493	0.848
	(2.739)	(2.141)
Landscape	2.033	2.372*
	(2.449)	(1.271)
Figurative (< 5 fig)	2.727	3.348***
	(2.347)	(1.283)
Figurative (5-10 figures)	12.329***	12.659***
	(2.383)	(1.403)
Figurative (>10 fig)	14.716***	14.999***
	(2.710)	(1.860)
Hedonic characteristics	YES	YES
Observations	732	732
R-squared	0.532	0.540

Robust standard error in parentheses

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

Table A1: Variables Definitions

Variables	Definition
VARIABLES OF INTEREST:	
GENRE and NUMBER of FIGURES	
Still lifes	Dummy =1 for a still life
Landscapes	Dummy =1 for a landscape
Genre paintings	Dummy = 1 for a genre
Portraits	Dummy = 1 for a portrait
Figurative paintings (1-4 fig)	Dummmy = 1 for a "figurative painting" (i.e., Sacred or History or Myth) with 1 to 4 fig.
Sacred (1-4 figures)	Interaction Sacred * Figurative (1 to 4 figures)
Historical & Literary (1-4 fig)	Interaction Histoy * Figurative (1 to 4 figures)
Mythological & Allegory (1-4 fig)	Interaction Myth * Figurative (1 to 4 figures)
Figurative paintings (5-10 fig)	Dummmy = 1 for a "figurative painting" (i.e., Sacred/History/Myth) with 5 to 10 fig.
Sacred (5-10 fig)	Interaction Sacred * Figurative (5 to 10 figures)
Historical & Literary (5-10 fig)	Interaction Histoy * Figurative (5 to 10 figures)
Mythological & Allegory (5-10 fig)	Interaction Myth * Figurative (5 to 10 figures)
Figurative paintings (>10 fig)	Dummmy = 1 for a "figurative painting" (i.e., Sacred/History/Myth) with > 10 fig.
Sacred (>10 fig)	Interaction Sacred * Figurative (> 10 figures)
Historical & Literary (>10 fig)	Interaction Histoy * Figurative (> 10 figures)
Mythological & Allegory (>10 fig)	Interaction Myth * Figurative (> 10 figures)
Battles	Interaction Battle* Figurative (> 10 figures)
CONTROL VARIABLES:	
PAINTINGS CHARACTERISTICS	
Size (square meters)	Size in square meters
Size (square meters) squared	Size in square meters squared
Number of commissioned paintings	Number of paintings for single and multiple commission
Copy from original	Dummy= 1 for a copy form original
Not on canvas	Dummy= 1 for paintings on a support different form canvas (e.g. copper etc)
Fresco	Dummy= 1 for frescos
CITY DESTINATIONS	
Rome	Dummy = 1 for destination Rome
Minor destinations	Dummy = 1 for destination to minor Italian town (see below)
Medium destinations	Dummy = 1 for destination to major Italian town (see below)
Exports	Dummy = 1 for foreign destination (see below)

LOCATION DESTINATIONS

Private palace	Dummy = 1 for destination private palace
Private collection	Dummy = 1 for destination private collection
Private chapel	Dummy = 1 for destination private palace
Church and other religious buildings	Dummy = 1 for destination church and other rel. buildings

PATRONS FIXED EFFECTS

Private patrons	Dummy = 1 when patrons are private families with at least 2 observations in the sample (see below)
Churches	Dummy = 1 when the patrons are urban churches
City of Rome	Dummy = 1 when the patron is the City of Rome
Foreign nobles	Dummy = 1 when the patron is a foreign noble
Kings' commission	Dummy = 1 when the patron is a king
Other religious institutions	Dummy = 1 for other religious commissions
Pope's commission	Dummy = 1 when the patron is a Pope
Vatican	Dummy = 1 when the patron is the Vatican
Vatican St. Peters	Dummy = 1 when the patron is the Vatican St. Peter

ARTISTS CHARACTERISTICS and FIXED EFFECTS

Artists	Dummy =1 for artists with at least 2 observations (see below)
Age of artist	Difference between payment date and year of birth
Immigrant	Dummy =1 for artists coming from outside Italy

OTHER

Time trend	Payment date
Plague	Dummy = 1 for the period 1656 1665 (aggregate demand shocks)

Table A1 (cont'd): Variable Definition

ARTISTS		PRIVATE PATRONS	DESTINATIONS
Abbatini	Morandi	Aldobrandini	**MINOR:**
Alberti	Nuzzi	Altemps	Ariccia
Arpino	Pace	Altieri	Bagnaia
Baderni	Passerotti	Barberini	Bassano di Sutri
Baglione	Pellegrini	Borghese	Bassano Romano
Belloni	Perfetta	Bornia	Caprarola
Bonzi	Pomarancio	Borromeo	Castel Gandolfo
Both	Porpora	Brancallero	Castel San Pietro
Brandi	Poussin	Campello	Catania
Bril	G. Preti	Capocaccia	Cesena
Brueghel	M. Preti	Cardelli	Fano
Camassei	Reni	Cerasi	Fara
Caravaggio	G. Romanelli	Chigi	Foligno
Caroselli	U. Romanelli	Colonna	Frascati
Carracci	Rondoni	Correggio	Lanuvio
Cerquozzi	Rosa	Corsini	San Quirico d'Orcia
Cerrini	Sacchi	de Rossi	Spoleto
Chiari	Salini	Farnese	Tivoli
Ciampelli	Saraceni	Filomarino	
Cigoli	Sassoferrato	Furgotto	**MEDIUM:**
Codazzi	G. Stanchi	Giustiniani	Arezzo
Courtois	N. Stanchi	Gonzaga	Ferrara
Cozza	Stella	Guicciardini	Florence
Cresti	Stom	Mattei	Mantua
Cortona	Swanevelt	Mazarin	Messina
V. de Boulogne	Tanari	Medici	Milan
Domenichino	Tassi	Nolfi	Naples
Dughet	Tempesta	Orsini	Palermo
Elsheimer	Tomasini	Pamphilj	Perugia
Ferri	Trevisani	Peretti Montalto	Pistoia
F. Napoletano	Turchi	Pointel	Siena
Galli	Vajani	Riviera	Venice
Gaulli	F. Vanni	Roscioli	
A. Gentileschi	R. Vanni	Rospigliosi	**EXPORTS:**
G. Gimignani	Viola	Ruffo	Antwerp
L. Gimignani	Vouet	Sacchetti	Austria
Gramatica		Santacroce	Dalmazia
Grimaldi		Santori	London
Honthorst		Savoia	Madrid
Jannetti		Sfondrato	Paris
Laer		Spada	Rouen
Lanfranco		Valguarnera	Switzerland
Leoni			
Lorrain			
Manfredi			
Maratti			
Maratti & Onofri			
Mattia			
Mei			
Miel			
Mola			