

# Art collections and taste in the Spanish *Siglo de Oro*

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**Abstract** We analyze art pricing in a unique dataset on Madrid inventories between 1600 and 1750. We estimate a price index for the Spanish art market that is used for a general historical analysis of art during this period, showing a large increase in the real price of paintings during the XVII century. Then we examine the price differential between domestic and foreign paintings: At the beginning of the century domestic production was priced substantially below imported paintings, but the price gap was gradually reduced during the century. We argue that such a price convergence was not the fruit of variations in real exchange rate, relative supply or home bias, but was associated with increasing prices for the new domestic painters of the XVII century. Increasing remuneration for painting may have induced artistic innovations by domestic producers and created the conditions for the development of the *Siglo de Oro* of Spanish art.

**Keywords** Schumpeterian hypothesis · Lopez hypothesis · International trade of paintings

**JEL Classification** Z11 · N0 · L14 · D4

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*“I judge that Spain is a pious mother to foreigners and a very cruel stepmother to her own native sons,”*  
Jusepe Ribera, *lo Spagnoletto* (1625)

Little is known about the evolution of art price indexes in pre-modern periods and about their relation with both the art market and the artistic innovations. Only recently, interdisciplinary research in cultural economics, economic history and art history has analyzed markets for paintings of the Baroque age, both primary markets (for instance see Spear and Sohm 2010; Etro and Pagani 2012, 2013; Etro et al. 2015) and secondary markets (Montias 1982, 2002; De Marchi and Van Miegroet 2006). Investigations from historical inventories have been focused on Amsterdam (Loughman and Montias 2001; Etro and Stepanova 2016), Antwerp (Martens and Peeters 2006), Venice (Cecchini 2000) and Florence (Pinchera 2014). Nevertheless, most of the datasets underlying these works are too limited in detail<sup>1</sup> to allow one to build a precise price index as it is possible for the following centuries on the basis of auctions' data.<sup>2</sup> A notable exception emerges from inventories recorded in Madrid between 1600 and 1750, which allow us to shed new light on art pricing in a pre-modern market and to provide two main contributions: First, we estimate a price index for the Spanish art market that is used for a general historical analysis of art during this period, and, second, we study the relative prices of domestic and foreign paintings.<sup>3</sup>

We analyze a dataset based on archival records of the inventories collected in Madrid during the Baroque age and largely put together at the Getty Research Institute (part of them were published and discussed in Burke and Cherry 1997). Through this dataset we investigate the evolution of art prices in general and separately for domestic and foreign painters in a period that is regarded as the Golden Age of Spanish art, the *Siglo de Oro*. We show two trends for the art market and for the same evolution of art history in this period: The first is the rapid and impressive increase in the relative price of all paintings in Madrid, which can be associated with the rapid increase in the Spanish demand for art, and the second is the gradual convergence of the price of domestic paintings toward the price of imported paintings. The Schumpeterian thesis that we suggest for this convergence is that the increase in art prices stimulated artistic innovations by domestic painters.

Our econometric analysis develops hedonic regressions on the price of paintings in Madrid adjusted for the cost of living based on the local price of wheat, which, at the time, was a main indicator of the cost of living in all the Mediterranean area. We first present a baseline regression on the full dataset with a complete set of explanatory

<sup>1</sup> In particular, a main determinant of prices, the surface area of paintings, is rarely documented in both Italian and Dutch inventories.

<sup>2</sup> For a survey on the econometric research on modern art auctions see Ashenfelter and Graddy (2003). On auctions in Paris during the XVIII and XIX century see Etro and Stepanova (2015).

<sup>3</sup> For an early discussion of the market for paintings in Spain in this period see Falomir (2006). A classic introduction to Spanish art history is Brown (1998).

variables and different specifications for the control of size.<sup>4</sup> Prices are increasing and concave in the surface area, are higher for paintings on canvas or with a golden frame compared to paintings on other supports or with a black frame, and are lower when multiple paintings are sold together. Price differentials between national schools and between genres appear *prima facie* substantial. On the basis of our baseline regression, we build a price index showing the rapid increase in the price of paintings during the XVII century and its decline during the first half of the XVIII century.

Then we focus on the smaller set of attributed paintings and control for both artists fixed effects and collectors fixed effects following the methodology applied in Etro et al. (2015) to obtain more precise estimates of the determinants of prices and of the price differentials between painters. Earlier correlations persist, but the price differential between genres becomes insignificant with the only exception of figurative paintings whose evaluation appears higher in this secondary market. On this basis, we analyze the price differential between Spanish paintings and imported ones. Local paintings were priced substantially below foreign ones at the beginning of the century, with the highest prices paid for the Italian painters and the lowest prices for the Spanish painters. Famous painters active in Spain during the XVI century such as El Greco and Alonso Sanchez Coello are associated with low prices, and masters of the early XVII century such as Francisco de Zurbaran, Francisco Ribalta and even Diego Velazquez are not associated with much higher prices. Remarkably, at the beginning of the century a great Spanish artist such as Jusepe Ribera had to move to Naples, at the time under Spanish control, to find the deserved compensation (others moved to the American colonies for the same purpose). Nevertheless, we show that the price differential between domestic and imported paintings was gradually eliminated during the XVII century, suggesting that convergence had taken place by the end of the century.

After establishing our two main results, the general increase in the price of paintings and the price convergence between Spanish and Italian painters during the XVII century, we investigate the possible sources of this convergence. We can fairly exclude that this was due to a relative decline in the price of imported paintings (for given quality) due to variations of the real exchange rate between Spain and Italy. Indeed, the XVII century was characterized by a slow deterioration of the Spanish real exchange rate due to the continuous flow of American silver which increased Spanish imports and deteriorated the terms of trade, increasing the relative price of imports. We can also exclude that the average quality of imported paintings did decrease due to oversupply, because the relative contribution of Italian paintings in the inventories remains substantially stable over time. The most likely motivation for the process of convergence in prices between Spanish and Italian paintings was simply an increase in the quality of the domestic production: This would be in line with a Schumpeterian process for which increasing prices induced artistic

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<sup>4</sup> A typical problem of hedonic regressions is the selection bias induced by the fact that the sample of paintings may not be representative of the entire set of paintings. This can be a problem with data from auctions (only for sold items), but not from inventories. However, one should keep in mind that poor collections may be underrepresented in the dataset. Moreover, the hedonic model assumes that the weight given to the various coefficients remains constant over the period of the model: While this is often unrealistic, as we will argue, pre-modern markets do not appear to be characterized by structural changes in pricing policies.

innovations by domestic painters, and created the conditions for the development of the golden age of Spanish art. To verify whether this was the case we focus on the subset of Spanish paintings and show that the price of the representative painting produced by domestic artists increased over time but also with the year of birth of the painter. This supports the idea that the quality of new domestic painters, as priced by the market, was indeed increasing for new painters entering in the market during the *Siglo de oro*, such as Velazquez, Murillo, Coello and other great masters. Instead, for the subset of Italian paintings, priced above others at the time, the price index is increasing but not positively correlated with the year of birth of the painters. In the absence of information on repeated sales and exact years of execution of the paintings, this is the most reliable evidence we can provide on the convergence of domestic quality to the imported quality as priced by the market.

The work is organized as follows. Section 1 describes the evolution of the art market in Spain between the XVI and the XVIII century. Section 2 describes the dataset and some basic features of the Baroque art collections in Madrid. Section 3 implements the empirical analysis. Section 4 concludes.

## 1 The art market in Baroque Spain

During the XVI century the demand of paintings in Spain was largely promoted by the interest of the Kings, first Charles I and then Philip II, both admirers and collectors of Titian and other Venetian artists.<sup>5</sup> During the second half of the XVI century, when Spain became for a short period the most powerful and the wealthiest empire on earth, “the empire on which the sun never sets,”<sup>6</sup> the popularity of paintings started to increase across the noble class, always eager to imitate royal habits. But most of the interest was for foreign painters, especially from Italy and Flanders, parts of which, as Naples and Antwerp, were under Spanish control. Painters active in Spain were still poorly considered and remunerated in the domestic market. This situation emerges clearly from what we know of the primary market for *retablos* (altarpieces) during the XVI century: In the main art centers, such as Seville, Valencia, Toledo and Madrid, commissions were often assigned in public auctions to the lowest bidding painter (Brown 1998), which kept prices low and certainly did not foster artistic innovation.<sup>7</sup> Meanwhile, mass production of

<sup>5</sup> As noticed by Brown (1998), “at Philip’s death, there were about 1150 paintings at the Escorial, about 300 at the Alcázar of Madrid, and perhaps 100 at the Pardo, totaling roughly 1500 in all. If it is assumed that about 200 came from the collections of Charles V and Mary of Hungary, then it can be conservatively estimated that Philip collected over 1000 pictures. This scale of acquisition is unprecedented in the history of collecting and represents the start of a new era—the one of the megacollector.”

<sup>6</sup> For a classic historical account see Braudel (1966).

<sup>7</sup> An alternative procedure used in the XVI century was the *tasacion*: The price was established *ex post* by a team of appraisers nominated by the artist and the patron or, in case of irreconcilable difference, by an arbitrator. As noticed by Brown (1998), also this process “worked against the artist because it required him to invest his time, skill, and money in advance of payment, leaving him nothing to hold over the patron in the event of a grievance.” El Greco experienced this hold up problem in more than one occasion: Evaluations for his important commission for the cathedral of Toledo (in 1579) ranged between 228 and 900 ducats, but at the end the painter had to accept only 317 ducats.

low-quality paintings was serving local demand and even colonial demand: Hundreds of paintings were shipped every year from Seville (which had the monopoly of colonial trade through the *Casa de la Contratacion*) to reach the viceroalties of Peru and New Spain (see Alcalá and Brown 2005).<sup>8</sup>

The reign of Philip III (1598–1621) started a period of gradual decadence for Spain from both an economic and a political point of view, which was much deeper than in the rest of southern Europe (see Hobsbawm 1954). As the recent economic history investigation by Álvarez-Nogal and De la Escosura (2013) has pointed out, this corresponds to a period of sustained fall in per-capita income which will continue beyond the middle of the century: Relative to the first decade of the XVII century (1600–1609) the per-capita real GDP decreased by 10–15 % in 1660–1669 and was still 3–5 % lower in 1740–1749 (see Álvarez-Nogal and De la Escosura 2013, Table A2). The crisis of the Spanish economy was associated with the decline in trading power and especially in wool exports and with a contraction in the purchasing power of American silver<sup>9</sup> which will force an inward-looking re-orientation of the Spanish economy toward a more agricultural, low-wage economy. It is widely recognized that at the end of the 500s the flow of silver increased imports in Spain, deteriorating its real exchange rate. The reduction in the price of Spanish exportable goods relative to the foreign importables left the traditional domestic industries in stagnation and decline for a long time (for evidence of such a form of “Dutch disease” see Drelichman 2005).

In spite of economic decline, the Crown kept spending large parts of its revenues in artworks, building palaces and decorating them with paintings mainly from abroad. New important collections were created by many aristocratic figures, starting with the administrator of the monarchy, the Duke of Lerma. However, it was only with the reign of Philip IV (1621–1665), that the demand for art started to increase rapidly at all levels. The King was a patron of Rubens and other contemporary artists, and his collection became the largest in the world (possibly of all times) with avid acquisitions which will become the core of the future Prado Museum. As noticed by Cherry (1997), “at the time of Philip’s death there were about 2600 pictures in only four of the many royal residences, out of a total that may have been as high as 5500, not to mention hundreds more assembled by royal initiative at the Escorial!...Furthermore, Philip was an amateur painter who, in spite of the social prejudices of his age, established relationships with Rubens and Velazquez that went far beyond the usual dealings of artists and royal patrons.”<sup>10</sup> Such a royal interest for painting spread around all the wealthy high society, leading

<sup>8</sup> Viceregal demand of religious paintings to decorate new churches was high, and Spanish and Flemish paintings were shipped during all the XVI and XVII century, sometimes also by important authors (such as the Carducho brothers or Zurbaran). Meanwhile, flourishing art centers were emerging in Mexico City (where a guild was established since 1555) and then Lima, Cuzco, Potosí, Quito and Santa Fe de Bogotá.

<sup>9</sup> The flow of silver increased enormously since 1540 and reached its peak in 1591–1595 (Drelichman 2005) after which it declined. The Crown was the main player in mining and was also entitled to the “royal fifth” of all private imports of treasure. A large portion of public spending (up to a fourth) was financed with the revenues from silver.

<sup>10</sup> We have detailed descriptions of most of the royal collections, but unfortunately they rarely include price evaluations.

to the development of new private collections rich of foreign works and also of domestic ones, traded at fairs and ports, through art dealers (*tratantes en pinturas*), and at auctions (*almonedas*). However, the best foreign works were imported from the foreign territories under Spanish control, especially Naples, through direct acquisitions by nobles, clergymen, ambassadors and Viceroy and through diplomatic gifts (Falomir 2006).

As we will verify, this increase in demand for art is associated with an increase in the price of paintings, which is probably what attracted foreign artists (as the Tuscan painters Angelo Nardi and the Carducho brothers or, at the end of the century, Luca Giordano)<sup>11</sup> but exerted also an impact on local painters: Indeed, it was in the first half of the XVII century that Spanish art finally flourished with an increasing supply of innovative talents. Even if limited compared to the Dutch experience, where entry of painters was massive in the same period (Montias 1982, 2002; Etro and Stepanova 2016), there was an increase in the number of local painters compared to the previous century: In 1599 Seville reached 27 registered masters, but the number increased further at the middle of the century, Valencia went from 23 in 1522 to 55 in 1607 (Falomir 2006), and Madrid reached 72 masters in 1625 and probably more in the second half of the century (Cherry 1997).<sup>12</sup> Self-consciousness of painters also increased, with the first *Academia de San Lucas* founded in Madrid in 1603 to defend the interest of painting as a liberal art.<sup>13</sup> All this led to the development of important artistic achievements and the emergence of talents such as Velazquez, Ribera, Zurbaran, Herrera and others associated with what today we call the *Siglo de oro* of Spanish art.

Meanwhile, the crisis of the Spanish economy continued during the second part of the XVII century, characterized by continuous and unsuccessful wars against France as well as against bankruptcy (Brown 1998, p. 233). Nevertheless, artistic commissions kept flourishing, not only in Madrid, but even in towns such as Seville and Valencia that were at the end of their major role in international trade: Most of these commissions came from aristocratic families, also because they were losing other investment opportunities, and from ecclesiastical institutions, which were financed with private donations. The core of the artistic golden age was reached in the middle of the century, but also the last part of it, under the reign of Charles II (1665–1700), was extremely vital and historical accounts tell us that Madrid remained a flourishing market for paintings. Brown (1998, p. 236–238) notices that

<sup>11</sup> Burke (1997) emphasizes that, in bringing Italian artists to decorate the Escorial (the so-called *escorialenses*), “Philip may be said to have secured an Italian foundation for the development of the seventeenth-century Spanish school of history and religious painting, just as his having brought Antonis Mor to the Iberian Peninsula added Netherlandish influence to Spanish portraiture” (p. 112).

<sup>12</sup> Even in our sample, the number of distinct Spanish artists mentioned in the inventories is 8 in 1600–1620, 16 in 1620–1640, 29 in 1640–1660 and 37 in 1660–1680 (the corresponding figures for Italians are 12, 24, 50 and 29). The entrepreneurial role of painters changed as well: Lower level painters started selling on the streets to reach a wider audience, while higher level painters joined in “companies” to optimize the supply of large quantities of paintings executed by the assistants and started to be engaged in trade of paintings by others.

<sup>13</sup> As the other traditional guilds, however, also this was mainly aimed at protecting the economic interest of the history painters, which is to promote high prices for the commissioned altarpieces and lobby against the 10 % tax on sales (*alcabala*).

“[w]hile it is true that there was no figure of the magnitude of Velazquez, the number of excellent painters, it can be argued, exceeded those who practiced during the reign of Philip IV. The causes of this creative upsurge in an epoch of drastic decline are far from clear, but a few hypotheses can be formulated. Some credit should be attributed to Philip IV, whose lifelong affection for painting did much to encourage artists and patrons alike.” Also Charles II promoted art and expanded the number of court painters. And the patronage of the church was paramount: “[t]he quantity of altarpieces produced in and around Madrid leaves no doubt that in one way or another, the church escaped relatively unscathed from the economic disasters of the reign... But how rural towns like Burguillos and Orgaz found the wherewithal to engage the services of Francesco Rizi, or Calzada de Oropesa those of Claudio Coello, is still to be discovered. Whatever the causes, the effect was a booming market for the painters of Madrid.”

The thesis that we suggest in this work is that the general increase in the price of all paintings stimulated artistic innovations by domestic painters. By artistic innovations we mean improvements in the quality of paintings as perceived by market and priced in the evaluations of the paintings. Therefore we will verify first that the prices increased in general and then that there was convergence between prices of Italian and Spanish paintings with similar characteristics. After showing such convergence we will check whether it could be due to an increase in the quality of works produced by the new Spanish artists entering in the market during the *Siglo de Oro*. It is important to remark that an increase in art prices exerts also a positive impact on the entry of domestic painters in the market, for which we have mentioned some evidence, but this works against price convergence as long as it increases domestic supply relative to demand.

This is not the first or the only historical market for art in which high demand and/or increasing prices appear to have attracted artistic innovations. The first formulation of this hypothesis we are aware of is due to the economic historian Lopez (1953). According to the so-called Lopez hypothesis, the demand for art flourishes in wealthy societies with a low marginal productivity of capital or about to enter in an economic crisis: Without high returns from investment in productive activities, as during Renaissance in Italy (see Etro 2016) or the Baroque age in Spain, investment in art by the (non-working) aristocracy expands and stimulates creativity.

Looking at the Dutch market of the XVII century, Montias (1982, 2002) has conjectured that increasing demand for art derived from the growth of the (working) bourgeoisie, and it attracted new innovative painters. Etro and Stepanova (2016) have provided some evidence in this direction with an econometric investigation on prices from inventories in Amsterdam: They find that changes in the price of representative paintings were correlated with the entry of new painters, which suggests a mechanism of entry driven by profitability in the art market.<sup>14</sup> The peculiarity of the current analysis is that the Spanish market was characterized by a

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<sup>14</sup> In the Dutch case the local school was already established in the market, so there were no issues of price convergence between local and foreign painters.

sort of duality between foreign and local supply, which allows us to study the convergence of the relative prices during a century of increasing demand for art.

## 2 The dataset on Madrid inventories

Our data on inventories cover the period between 1600 and 1750, with a total of 167 inventories and 13 thousand paintings evaluated.<sup>15</sup> As usual at the time, the motivation for these inventories ranges from the death of the owner, to marriages, business contracts, sequesters, changes of residences and estate sales. An average collection in Madrid contains seventy-five paintings if we exclude the three collectors with over a thousand paintings, namely Gaspar de Haro, Marques de Eliche,<sup>16</sup> Juan Gaspar de Cabrera<sup>17</sup> and Diego Messia, Marques de Leganes.<sup>18</sup> Like them, most of the collectors belong to the aristocratic class, as in the notable cases of Manuel de Fonseca y Zuniga, Conde de Monterrey<sup>19</sup> and Ramiro Felipez de Nunez de Guzman.<sup>20</sup>

The fraction of paintings that belong to nobles is high and stable over time (contrary to what happened in the Dutch inventories, where the importance of the middle class was rapidly increasing). However, we have also records of collections owned by royal secretaries and administrators, such as Jeronimo de Cuellar and Diego de la Torre, legal experts such as Sebastian de Cotes y la Carcel and some middle-class collectors. These included merchants as the jeweler Joseph de Lezana, the silk merchant Francisco Diaz de la Hoz or the silversmith Luis de Zabalaza, accountants (Jeronimo de Alviz or Luis Fernandez de Vega), clergymen (Juan de Espina or Juan de Fonseca y Figueroa), doctors (Juan de Matute) and painters (Vicencio Carducho). Descriptive statistics for our inventories are presented in Table 1, distinguishing between the full dataset and the subset of attributed paintings.

<sup>15</sup> A description of 134 inventories is in Burke and Cherry (1997). Data from 166 inventories derive from the Getty Research Institute, but we added paintings from the inventory of the Leganes collection as reported in Perez (2010).

<sup>16</sup> Gaspar de Haro (1629–1687) inherited an already large collection from the father, Luis. He was sent to Rome as ambassador and to Naples as Viceroy. At his death, he owned over 3000 pictures, approximately 1200 of which were kept in his houses in Madrid (Brown 1998) and the rest in Italy.

<sup>17</sup> Also Juan Gaspar de Cabrera (1625–1691) inherited a large collection from the father Juan Alfonso, Viceroy of Sicily and then Naples, and spent his life in Spain preserving and enhancing his collection. The inventory from his palace classifies rooms entirely dedicated to painters such as Raphael, Tintoretto, Titian, Bassano, Ribera, Orrente, Rubens and a room for the “Spaniards.”

<sup>18</sup> The Marqués de Leganés (1580–1655) was an army commander active in the Spanish Netherlands and North Italy. See Volk (1980) on his collection mainly focused on Flemish artists and Perez (2010) for its detailed description.

<sup>19</sup> The collection of the Count of Monterrey (1586–1653) was largely build in Naples between 1628 and 1637. There, he was also in charge of purchasing old masters’ paintings for the King (as Titian’s *Bacchanal of the Andrians* and the *Worship of Venus*, now both at the Prado) and commissioning new ones (for instance from Lanfranco, Domenichino and Stanzione). Similarly Luis de Haro had been in charge of acquisitions from the English Royal collection and the King’s brother, the cardinal infante Ferdinand, had been in charge of acquisitions from Flanders (see Brown 1998).

<sup>20</sup> Ramiro Felipez de Nunez de Guzman (1600–1668) was well known as a patron of Ribera in Naples. His small collection contained Raphael’s *Madonna of the Fish* (now at the Prado).



**Table 1** Descriptive statistics

Variable	Full sample			Sample of attributed observations		
	(12,993 observations)			(2328 observations)		
	Mean	SD	Av. price (reales)	Mean	SD	Av. price (reales)
Price (reales)	723	5079		2003	11,122	
Copy	0.032	0.176	546	0.174	0.379	547
Anonymous painting	0.799	0.401	436	–		
Dutch school	0.001	0.032	681	0.005	0.072	726
Flemish school	0.046	0.21	1813	0.212	0.409	2069
Italian school	0.089	0.285	2893	0.476	0.5	2983
Spanish school	0.058	0.234	582	0.308	0.462	578
Uncertain attribution	0.007	0.085	824	–		
Unknown genre	0.096	0.295	568	0.029	0.167	450
Figurative	0.568	0.495	881	0.56	0.496	2787
Genre	0.031	0.173	827	0.066	0.248	1167
Landscape	0.09	0.287	351	0.093	0.291	628
Portrait	0.141	0.348	592	0.157	0.364	1543
Still life	0.074	0.262	371	0.095	0.294	549
Surface area ( <i>S</i> ) unknown	0.852	0.355	594	0.574	0.495	1784
<i>S</i> < 0.5 square meters	0.029	0.167	663	0.095	0.293	888
<i>S</i> ∈ (0.5, 1) square meters	0.037	0.188	949	0.104	0.305	1481
<i>S</i> ∈ (1, 1.5) square meters	0.026	0.158	1083	0.072	0.258	1750
<i>S</i> ∈ (1.5, 2) square meters	0.014	0.119	1241	0.04	0.197	1949
<i>S</i> ∈ (2, 3) square meters	0.02	0.141	1707	0.052	0.221	2932
<i>S</i> ∈ (3, 4) square meters	0.008	0.09	2391	0.022	0.146	4088
<i>S</i> > 4 square meters	0.014	0.116	4611	0.042	0.201	7057
Unknown support	0.666	0.472	585	0.717	0.451	1602
Canvas	0.162	0.369	1108	0.173	0.378	2480
Wood panel	0.079	0.271	1431	0.071	0.257	5241
Lamina	0.092	0.289	445	0.039	0.194	1431
Golden frame	0.213	0.41	732	0.268	0.443	1832
Black frame	0.198	0.398	495	0.21	0.407	1415
Noble collector	0.534	0.499	1076	0.552	0.497	3160
Current place known	0.005	0.069	17,075	0.022	0.146	20,384

Notarized appraisals (*tasaciones*) were mainly done by painters,<sup>21</sup> and occasionally by amateurs (notaries, priests and royal functionaries) following a rigid procedure (and within thirty days from death in case of death inventories)

<sup>21</sup> For instance, we know that the inventories of Leonor Maria de Guzman and Manuel de Fonseca y Zuniga were appraised by Antonio de Pereda, those of Juan de Castaneda and Joseph Salvador Sarmiento by Palomino, those of Antonio de Mardones and Miguel de Salamanca by Juan de Miranda, the inventory of the doctor Alonso Cortes was evaluated by Vicencio Carducho, and the one of Juan Gaspar de Cabrera by Claudio Coello.

for a small fee. Evaluations were reliable because they were aimed at establishing a fair price for a subsequent public sale, in which sellers and buyers could make recourse for prices below or above 50 % of the appraised value (Cherry 1997).

The majority of prices are recorded in the unit of account of the time, the *real de plata* (whose corresponding coin, the silver *real de vellon*, was consistently devaluated at the end of the XVII century), but some prices are recorded in *ducados* (equivalent to 11 reales), *doblones* (equivalent to 60 reales) or *maravedies* (1 real corresponds to 34 maravedies), so we translated all prices in reales de plata (and excluded few evaluations in real de vellon). Moreover, to convert nominal prices in real values we normalized them with the annual price of wheat, which is our best available proxy for the cost of living. We obtained information on the annual price of wheat in Madrid from the dataset built by Robert Allen (*Global Commodity Price Database*):<sup>22</sup> in this dataset prices of wheat are nominated in grams of silver per liters of wheat, and since we know that eight reales contained 24.47 g of silver, we are able to convert prices in reales into prices “in liters of wheat” for the empirical analysis.

The average (nominal) price of paintings is 723 reales; the cheapest attributed painting is a (probably unfinished) portrait by Bartholmè Carducho evaluated 6 reales in the 1638 inventory of the brother Vicencio, while the most expensive one is a *Venus with Mercury and Cupid* by Correggio, evaluated 420,000 reales in the 1689 inventory of Gaspar de Haro (currently at the National Gallery in London). The collection of Gaspar de Haro included also the most expensive Flemish paintings (two portraits, one by Rubens and one by van Dyck evaluated 55,000 reales each) and the most expensive Spanish paintings, a *Nativity* by Ribera evaluated 33,000 reales and the celebrated *Rockeby Venus* by Velazquez, evaluated 16,500 reales (today at the National Gallery). We can get a sense of the relative price of these paintings by noting that unskilled workers in the 1620s received one real as a minimum day’s wage and in royal sites they could reach up to five reales (Burke and Cherry 1997).

The majority of paintings lacks a precise attribution, but 18 % of the observations report the author, which is a precious source of information on the taste of Spanish collectors. Only for 17 % of the attributed observations there is an explicit mention that the works are copies from originals of a master (but, of course, some of the other attributions could have been wrong or too generous). The cited artists belong mainly to the Italian school (43 %), the Spanish one (29 %) and the Flemish and Dutch schools (24 %), while the remaining 4 % of the observations are attributed to unknown artists.<sup>23</sup> Italian authors conserve the relative majority of the attributed works in Spanish inventories, and these percentages are rather stable over the

<sup>22</sup> The same dataset provides an attempt to build a series for CPI, which, however, gives a weight of 80 % to the price of wheat. Our results are substantially unchanged using this series.

<sup>23</sup> Three foreign painters (El Greco, Nardi and Carducho) are classified within the Spanish school because they spent most of their careers in Spain. We had also three paintings attributed to English painters and twenty four attributed to French painters, which we excluded from the analysis due to considerable underrepresentation (but Dughet is included in the Italian school). The only German painters are Durer and Holbein.

century: The most common authors are the Bassanos, Titian, Tintoretto, Giordano, Raphael, Codazzi, Cambiaso, Veronese and Reni. Between Flemish painters Rubens and van Dyck are the most frequent authors followed by Brueghel (a label associated with multiple members of the family of painters) and Juan de la Corte, who, however, was mainly active in Spain. The most frequent Spanish painters are Pedro Orrente and Juan van der Hamen y Leon followed by Diego Velazquez, Eugenio Caxes, Alonso Sanchez Coello and El Greco. Only one portuguese painter appears in the dataset, Bartolomé de Cárdenas, who was active in Spain as well.

Paintings attributed to the Italian school have the highest average price of almost 3000 reales, followed by the Flemish and Dutch school, while the local school has the worst evaluation with less than 600 reales for an average painting attributed to a Spanish painter. This may reflect a preference for foreign art, a selection bias (if higher quality paintings were imported), or simply a lower average quality of the Spanish paintings in this period. However, as we will see, these absolute price differentials hide a convergence in prices during the century.

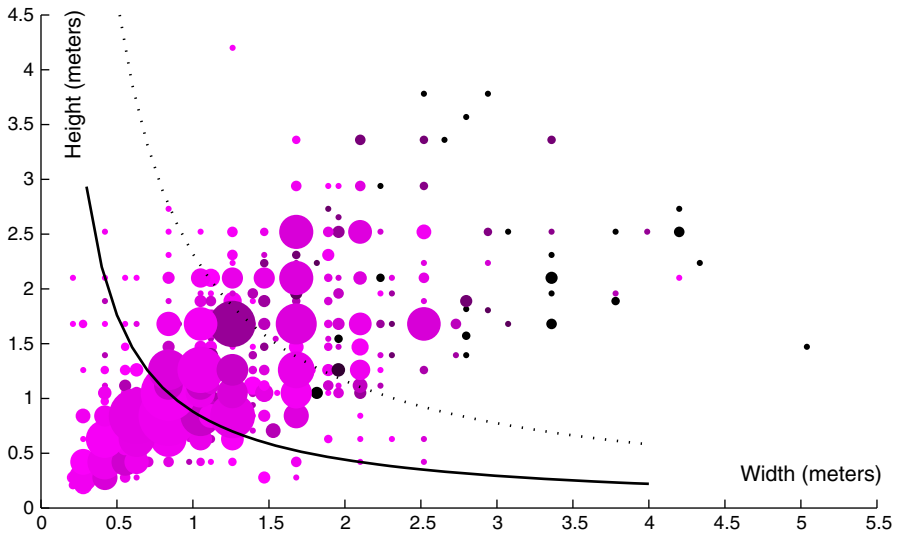
The height and length of paintings are precisely indicated for an exceptionally large part of the sample compared to other contemporaneous inventories as the Italian ones (Cecchini 2000; Pinchera 2014) or the Dutch ones (Montias 1982), which usually do not report exact sizes. We know the exact size for 14 % of all the paintings and 43 % of the attributed ones. The measure is in *vara* or *palm* which we convert into meters (1 *vara* is 83.6 cm and 1 *palm* is 21 cm). The average surface area is 2.32 square meters and is stable over time.<sup>24</sup> In Fig. 1 we provide a visual description of the distribution of paintings by surface area. The horizontal axis reports the width of paintings and the vertical one their height: The size of each circle corresponds to the frequency of paintings with such a dimension, while a darker color reflects a higher average price.<sup>25</sup> The solid line is the *iso-size locus* corresponding to the modal surface area, while the dotted line is the *iso-size locus* corresponding to the average surface area. Most paintings are distributed along two rays, corresponding to landscape-oriented paintings and portrait-oriented paintings, with prices increasing in dimensions.<sup>26</sup>

For 21 % of the observations the inventory mentions a golden frame which could increase the value of the work compared to the more common black frames. As usual, supports include canvases (*lienzo*), panels (*tabla*) and other smooth surfaces (*lamina*). For a small selected group of high-quality paintings (2.2 % of the attributed observations) the dataset reports the current location of the painting, which is a proxy for fame and quality of the painting. In 29 % of the observations multiple paintings were evaluated together for reasons related to the subject (as for series of the twelve months): In such cases we built a variable indicating how many paintings were in such a group (with twelve as the upperbound to exclude spurious

<sup>24</sup> Contrary to this, Dutch inventories have shown a gradual reduction in average size during the 600 s (Etro and Stepanova 2016), mainly aimed at satisfying the new demand of the middle class.

<sup>25</sup> Rounding by appraisers leads to discrete jumps in the surface areas.

<sup>26</sup> Recently, Higgs and Forster (2014) have argued that departures from standard proportions, namely from the classic ideal of *golden ratio* between height and length, can affect prices, but they have tested such hypothesis on modern auctions and modern art, and not on historical periods in which the link with the classic ideal of the golden ratio could be stronger.



**Fig. 1** Height/width distribution. *Note:* Size of the circle corresponds to the frequency of such height/width combination; circle color corresponds to the average price of such height/width combination: Darker is the color, higher is the price; dotted line indicates average surface area of 2.32 m<sup>2</sup>; black line indicates the modal area of 0.88 m<sup>2</sup> (color figure online)

multiple evaluations). We also measured the length of the description of the paintings in the inventory (in letters), which is usually a rough proxy for the quality of the paintings as perceived by the appraisers.

We were able to classify most paintings (from the title and the description) into the five traditional genres: figurative paintings, genre paintings, landscapes, portraits and still life paintings (*bodegones*). The residual category (unknown genre) includes paintings whose description is absent or unclear in the inventory.<sup>27</sup> The majority of paintings in the Baroque collections of Madrid, and by far the most expensive, were the figurative ones, including religious, mythological and historical subjects plus the battles. Religious subjects were prevailing, accounting for half of the observations, while mythological subjects were relatively rare in the collections and, even more, in the local production (Brown 1998), possibly because of the pressure of the *Inquisition* or, more simply, because of the foreign leadership in the subject. Portraits and genre paintings had lower evaluations compared to the figurative paintings, while landscapes and still lifes were the least valuable. Of course, price differentials were larger between attributed paintings compared to the full dataset, which includes a fringe of low-quality products, but the distribution across genres and the relative prices were rather stable over time.<sup>28</sup>

<sup>27</sup> In our classification, landscapes include *hermitanos* (which depicted hermit saints in the composition) and portraits include typical depictions of dwarves (*enanos*), clowns (*bufones*), drunks (*borrachos*) and madmen (*locos*) that had a genre content.

<sup>28</sup> Also this is in contrast with the Dutch experience, where the share of landscapes and minor genres increases over the same period (Etro and Stepanova 2016).

Contrary to the Dutch inventories (Loughman and Montias 2001) we do not have much information on the houses hosting the collections and on the placement of paintings in rooms, but we know that in aristocratic palaces the portraits were mostly in the library room, devotional pictures in the bedrooms and hunting scenes in the dining room, and that tapestries often covered paintings during the winter (Cherry 1997). Finally, we know when the collector was noble (namely a Duque, a Marques, or a Conde), which we expect to signal a higher willingness to pay for art and therefore richer collections.

### 3 Empirical analysis

In this section we present the hedonic regressions for the price of paintings in Madrid, derive the corresponding price index and examine price differentials between domestic and imported paintings. A couple of remarks should come first.<sup>29</sup> A typical problem of hedonic regressions for the price of paintings is the selection bias induced by the fact that the sample may not be representative of the entire set of paintings in the market: This is indeed a problem when one builds a price index from auctions' data, where only some of the paintings are auctioned and only some of them are actually sold and therefore priced. Inventory data do not suffer from this last form of selection bias, but certainly they are generated from collections of high enough value and quality (to have been subject of careful inventories that survived until our days). While each inventory contains paintings of heterogeneous quality and price, it is likely that low-price paintings by anonymous painters are probably underrepresented in the sample relative to the universe of paintings present in the country. This is not a problem as long as we are interested in analyzing the high segment of the market, but it could represent a problem in comparing domestic and foreign paintings if the selection bias affects them differently. For this reason, after looking at the full dataset we will restrict the analysis to attributed works, which is likely to avoid the problem as long as attributions tend to be recorded only for works of high enough quality independently from the national school.

Second, the hedonic model assumes that the weight given to the various coefficients remains constant (as estimated from the regression) over the period of the model, which here is over a century long. While this is often an unrealistic assumption, pre-modern markets do not appear to be characterized by substantial changes in preferences and technologies that would justify important changes in the structure of art pricing. Moreover, we have not found relevant variations in the distribution of our variables over time. Our baseline regressions on the entire period are presented in Table 2, and the Online Appendix provides descriptive statistics and identical baseline regressions for three separate periods of 50 years: They reveal the absence of relevant changes in the coefficients of explanatory variables over time.

In our regressions the dependent variable is the log of the price of paintings adjusted for the price level. To maximize the number of observations in all the

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<sup>29</sup> We are thankful to the referees for pointing out these remarks and their implications.

Table 2 Price regressions

	Regression (1)	Regression (2)	Regression (3)
Year	0.409*** (0.0302)	0.469*** (0.0688)	
Year squared	-0.000119*** (0.00000895)	-0.000137*** (0.0000204)	
Collectors fixed effects			(Yes)
Artists fixed effects		(Yes)	(Yes)
Anonymous painting	Omitted	-	-
Copy	-0.518*** (0.0623)	-0.975*** (0.0613)	-0.976*** (0.0686)
Spanish school	0.531*** (0.044)		
Dutch school	0.577*** (0.121)		
Uncertain attribution	0.637*** (0.116)		
Flemish school	1.058*** (0.055)		
Italian school	1.080*** (0.0407)		
Unknown genre	Omitted	Omitted	Omitted
Figurative	0.105*** (0.035)	0.721*** (0.119)	0.572*** (0.144)
Genre	0.301*** (0.065)	0.499*** (0.141)	0.170 (0.174)
Landscape	-0.313*** (0.046)	0.376*** (0.142)	0.188 (0.168)
Portrait	-0.327*** (0.042)	0.005 (0.133)	-0.126 (0.156)
Still life	-0.425*** (0.049)	0.290 (0.180)	0.166 (0.202)
Surface area ( <i>S</i> ) unknown	Omitted		Omitted
<i>S</i> < 0.5 square meters	-0.403*** (0.062)	-0.206*** (0.072)	-0.133* (0.081)
<i>S</i> ∈ (0.5, 1) square meters	-0.147*** (0.055)	-0.061 (0.071)	0.043 (0.079)
<i>S</i> ∈ (1, 1.5) square meters	0.136** (0.064)	0.176** (0.081)	0.295*** (0.089)
<i>S</i> ∈ (1.5, 2) square meters	0.207** (0.084)	0.456*** (0.101)	0.578*** (0.114)
<i>S</i> ∈ (2, 3) square meters	0.406*** (0.071)	0.583*** (0.092)	0.690*** (0.098)
<i>S</i> ∈ (3, 4) square meters	0.675*** (0.110)	0.762*** (0.136)	0.875*** (0.151)

Table 2 continued

	Regression (1)	Regression (2)	Regression (3)
S > 4 square meters	1.239*** (0.087)	1.264*** (0.104)	1.391*** (0.111)
Unknown support	Omitted	Omitted	Omitted
Canvas	0.231*** (0.029)	0.350*** (0.057)	0.406*** (0.072)
Wood panel	0.210*** (0.038)	0.204** (0.085)	0.147* (0.084)
Lamina	0.047 (0.036)	0.209* (0.119)	0.359*** (0.124)
Nr. paintings evaluated	-0.118*** (0.006)	-0.033*** (0.012)	-0.059*** (0.014)
Golden frame	0.143*** (0.025)	-0.003 (0.048)	0.155*** (0.055)
Black frame	-0.054** (0.026)	-0.089* (0.052)	0.065 (0.062)
Noble collector	0.222*** (0.023)	-0.0008 (0.0574)	
Av. price rest of collection	0.00008*** (0.000002)	0.00009*** (0.000003)	
Description length	0.003*** (0.0001)		
Current place known	0.937*** (0.145)		
Constant	-344.7*** (25.38)	-394.5*** (57.87)	6.980*** (0.264)
Observations	12,993	2328	1927
Adjusted (R <sup>2</sup> )	0.47	0.72	0.76

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  Standard errors in parentheses

regressions of Table 2 we control for size through a set of dummies for different size categories and an omitted category with the large group of paintings whose size is unknown. The time trend is controlled with a linear and a quadratic term to anticipate the inverted-U pattern of prices, which will be later shown through the price index. We first present a baseline regression (1) on the full dataset with a complete set of control variables but without fixed effects for artists or collectors; however, we partially control for the quality of the artists through dummies for the national schools of the painters and for the characteristics common to each collector (through the average price of the paintings present in the same collection and some dummies correlated with quality). Then we present a regression (2) limited to the attributed paintings with a full set of artists fixed effects that provide a good control for quality characteristics. Finally, the last regression (3) is limited to painters represented with different works in different collections and includes both artists fixed effects and collectors fixed effects following the methodology applied in Etro et al. (2015). Selected fixed effects for artists and collectors are reported in the Online Appendix, where we omitted the artist Ribera, as the only Spanish artist whose career was entirely spent in Italy, and the collection of Pedro Nunez de Guzman, Conde de Villaumbrosa, Marques de Montealegre, who left a collection (inventoried in 1683) rich of Spanish works (including some by Orrente, Valdés Leal, Diaz and van der Hamen).

Prices appear to depend on objective features of the paintings (size, originality, attribution) and of the inventory. The baseline regression shows a ranking of prices across genres, with figuratives and genre paintings better paid than landscapes, portraits and, at the bottom, still lifes; however, these price differentials for the secondary market tend to disappear in the full specification, with the only exception of the figurative paintings which remain overpriced relative to the other genres, possibly reflecting additional unobservable characteristics (see Etro et al. 2015). As expected, golden frames increase the price compared to black ones. Mixed results emerge concerning the support of the painting, but canvases are always associated with higher prices than wood panels and other smooth supports. Usual control variables, such as the length of the description of the painting in the inventory (measured in number of letters), the average price of the rest of the collection and the fame of the painting (proxied by the fact that we know its current location), are positively correlated with prices. Remarkably, noble collectors have paintings whose evaluations are substantially higher than the other collectors, but this difference disappears after controlling for the quality of collections with the appropriate dummies for the artists' fixed effects. In Table 3 we have replicated the same specifications only for the paintings whose exact surface area is known and controlling for this with linear and quadratic terms, which supports the robustness of the results above and emphasizes the precise concave relation between prices and surface area.<sup>30</sup>

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<sup>30</sup> In this specification, we find that the evaluations of the paintings decline with unusual proportions, in particular when the ratio between long and short size increases and when the surface area departs from its mode (see Higgs and Forster 2014). However, once we control for the quality of paintings with the artist fixed effects, the explanatory power of the mentioned ratio and of the distance from the modal area disappear. Accordingly, differences in width and height do not affect evaluations of paintings for a given surface area: In other words, the *iso-size loci* of Fig. 1 could be interpreted as indifference curves.



**Table 3** Price regressions for paintings with known size

	(1)	(2)	(3)	(4)
Year	1.107*** (0.0666)	1.108*** (0.0665)	1.104*** (0.0663)	1.494*** (0.105)
Year squared	-0.000325*** (0.0000197)	-0.000326*** (0.0000197)	-0.000325*** (0.0000196)	-0.000438*** (0.0000312)
S	0.442*** (0.0268)	0.442*** (0.0268)	0.606*** (0.0483)	0.418*** (0.0607)
S <sup>2</sup>	-0.0192*** (0.00269)	-0.0192*** (0.00269)	-0.0133*** (0.00304)	-0.0104*** (0.00315)
Ratio long/short side		-0.121*** (0.0401)	-0.118*** (0.0399)	-0.0320 (0.0525)
Deviation from modal surface area			-0.245*** (0.0600)	-0.0720 (0.0740)
Control variables	(Yes)	(Yes)	(Yes)	(Yes)
Artist FEs	(No)	(No)	(No)	(Yes)
Observations	2113	2113	2113	1184
Adjusted R <sup>2</sup>	0.57	0.57	0.57	0.70

Standard errors in parentheses; \*\*\*  $p < 0.01$

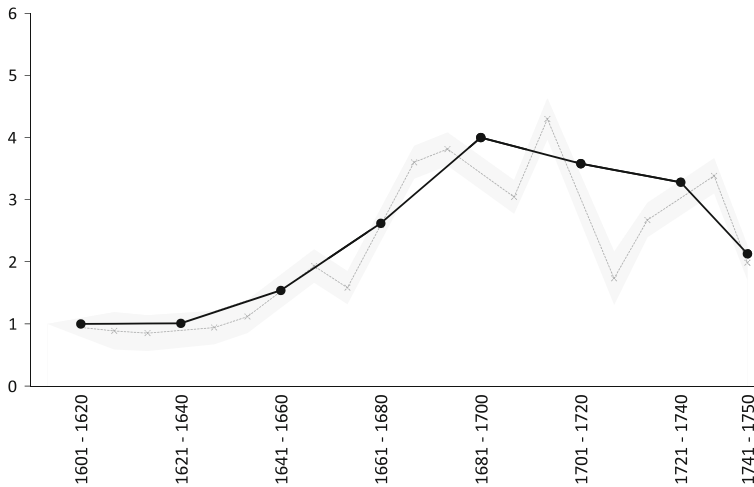
Set of control variables includes variables used in the baseline regression (Table 2 Regression (1))

### 3.1 The price index

All the regressions controlling in different ways for size and other quantifiable features of the paintings emphasize an inverse-U relation between the real price of paintings and time, with a rapid increase during the golden age and a decline only in the first half of the following century. The peak of the parabola is around the turn of the century. We have run regressions identical to regression (1) of Table 2 replacing the quadratic time trend with different sets of period dummies, but retaining all the other control variables (except for the average price of the paintings which would spuriously affect the index). This allows us to build the hedonic price index for two cases with 10-year dummies and with 20-year dummies as shown in Fig. 2. The increasing trend of the real price of paintings over the XVII century is largely confirmed, while a slow decline is visible in the first half of the following century.<sup>31</sup>

We do not have evidence on enough repeated sales of paintings to build a repeated sale price index, but fragmentary observations provide additional support for the rapid increase in prices during the XVII century. We detected few sure repeated sales, two of which were present first in the 1648 inventory organized by Luis de Haro at the death of his wife Dona Catalina, and then in the 1689 death inventory of their son Gaspar de Haro: a portrait by Velazquez of the Principe de Asturias, which increased in value from 1500 to 5500 reales, and a *Christ washes*

<sup>31</sup> While the general pattern is similar, the price index based on 10-year dummies is biased in the early 700s for the small number of inventories present in that period.



**Fig. 2** Price indexes for the Spanish art market (1600–1750). *Note:* In black is the index by 20 year periods, in gray is the index by 10 year periods with 95 % confidence interval

*the feet of the apostles* by Tintoretto, which increased from 6600 to 11,000 reales.<sup>32</sup> *A Mars and Venus* by Rubens appears in 1647 in the collection of the IX Almirante de Castilla with an evaluation of 3000 reales and reappears in 1691 in the collection of the X Almirante de Castilla for 7000 reales.

In line with these examples, the price indexes in Fig. 2 show that the price of a representative painting doubled between the beginning and the middle of the century and doubled again in the second half of the century, reflecting the wide expansion of the demand for art. Since Spain reached high levels of wealth by the end of the XVI century and went through a slow economic decline during the following century (largely documented in Alvarez-Nogal and De la Escosura 2013), this appears consistent with the Lopez (1953) hypothesis, for which the demand for art flourishes in wealthy societies with reduced investment opportunities for the aristocratic class. Further investigations would be useful.

### 3.2 Fixed effects

Looking at the fixed effects (Online Appendix) we can infer the extra price for a representative painting by a given artist after controlling for differences across collectors. Many of them, mostly nobles, were collecting high-quality paintings by their favorite artists: This was especially the case for Gaspar de Haro, but also other large-scale collectors (such as Juan de Castaneda, Juan Gaspar Enriquez de Cabrera, Antonio Mesia de Tovar, Manuel de Fonseca y Zuniga and, to a lesser extent, the

<sup>32</sup> The 1689 inventory of Gaspar de Haro contains also an equestrian portrait by van Dyck evaluated 55,000 reales that could be the anonymous portrait evaluated 1000 reales in 1648, and a Santa Cathalina by Titian evaluated 22,000 reales which should be the one in the collection of the Conde de Monterrey in 1653 evaluated 4950 reales.

Marqués de Leganes all together) and some minor collectors who were purchasing a lower number of precious paintings, sometimes non-aristocratic figures searching for social recognition (such as Jeronimo de Cuellar, Francisco de Oviedo or Pedro de Arce).<sup>33</sup> At the same time, other collectors could only put together works of lower value, as was the case for Fernando de Borja y de Aragon, Pompeo Leoni or Jeronimo de Alviz whose collections were nevertheless large. Since we are controlling for artists' fixed effects and we are considering evaluations in the secondary market, significant differences between collectors must reflect differences in their willingness to pay for quality.<sup>34</sup>

Controlling for these differences, the best prices for artists were associated with the Italian school, mainly with old Venetian masters such as Titian, Veronese, Tintoretto and the Bassanos (especially in case of original works by Jacopo Bassano), but also Correggio, Giulio Romano and Raphael, or painters from the 600s such as Caravaggio and Stanzione, who had been both active in Naples, at the time within Spanish territories. Only the contemporary Flemish school can occasionally reach prices comparable to those of the Italians, especially with van Dyck and Rubens, but also with some genre painters and still life painters such as Snyders and Brueghel. The Dutch school follows, primarily with the portraits of Anthonis Mor.

Our regressions show that the average prices for the paintings of artists active in Spain are much lower than the paintings by foreign artists. As long as artistic quality is priced by the market, this implies that the quality of domestic paintings was on average lower compared to imported paintings: In other words there is no evidence of home bias in the market for art of Madrid. Indeed, there are no Spanish painters that are priced significantly more than Ribera (the omitted artist), who was Spanish but spent most of his career in Naples and was well aware of this fact: As he noticed in 1625, "Spain is a pious mother to foreigners and a very cruel stepmother to her own native sons." We also know that minor Spanish painters will constantly move to the viceroalties of Peru and New Spain searching for attractive commissions. Between the Spanish artists recorded in our inventories, the highest evaluations are reached by some of the best masters trained in Seville in the second half of the XVII century, such as Bartolome Murillo and Alonso Cano,<sup>35</sup> and in Madrid, such as Jusepe Leonardo and Claudio

<sup>33</sup> Jeronimo de Cuellar was a collector of works by Velazquez, while Pedro de Arce, a member of the royal honor guard, put together a collection with remarkable Spanish paintings, including the celebrated *Fable of Arachne* by Velazquez, evaluated 5500 reales in 1664. Cherry (1997) notices that art collecting was often a way to improve the social condition following the taste of the King Philip IV: "collecting might have been a means of catching Philip's eye. This is not to suggest that Arce, Cuellar, and other courtiers of middle rank collected merely to advance their careers, but it does indicate that seventeenth-century society, to use a biological metaphor, tended to select in favor of those who owned pictures" (p. 187).

<sup>34</sup> In particular, they cannot reflect incentive mechanisms toward the artists, as it would be the case for a primary market, where the price is the direct compensation of the painter (on that case see Etro et al. 2015).

<sup>35</sup> Both of them were also active in Madrid, where we know that Murillo was paid 2600 reales for an altarpiece in 1661 (Brown 1998, p. 206). Murillo's compensations were much higher in Seville, where in 1670 he was paid 13,300 and 15,975 reales for two large canvases for La Caridad. He supplied also international private collectors with smaller figurative and genre paintings, becoming the only painter active in Spain who achieved an international reputation during its own lifetime.

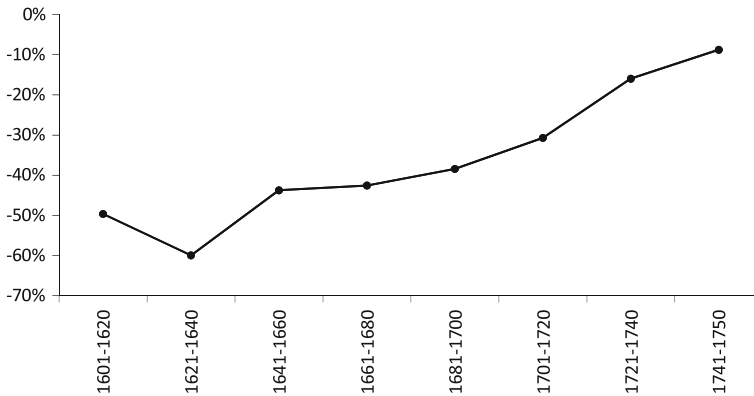
Coello, but the frequency of their works is limited in the dataset and none of them is priced significantly more than Ribera. More common in the collections are other established painters of the *Siglo de oro*, and the highest evaluations between them are for Vicencio Carducho, Angelo Nardi, Pedro Orrente and, only behind them, the greatest Spanish master, Diego Velazquez.<sup>36</sup> Some local painters of the XVI century appear frequently in the inventories, and few of them, namely Juan Fernandez de Navarrete (El Mudo) and Luis de Morales (El Divino), record relatively high prices, but El Greco, and Alonso Sanchez Coello, probably the most important painters of the mannerist period, report much lower prices. Even lower evaluations are usually obtained by portraitists such as Juan Carreno, still life painters such as Antonio de Pereda, Juan de Arellano and Juan van der Hamen y Leon, landscape painters such as Francisco Collantes and genre painters such as the noble Pedro Nunez de Villavicencio. Interestingly, a great Sevillian master of the first half of the XVII century, Francisco de Zurbaran, is associated with very low prices, probably reflecting the simple devotional pictures produced by his workshop for the national market in Seville, which was losing all its economic and artistic influence in the middle of the XVII century;<sup>37</sup> the same can be said for Francisco Ribalta, leading artist in a decaying Valencia.<sup>38</sup>

A main message emerging from the empirical analysis above is that domestic paintings were consistently evaluated less than imported paintings in Madrid, possibly reflecting both a lower quality of the Spanish school and a selection effect. The latter could be due to the fact that most of the low-quality paintings were probably anonymous works bought in the domestic market rather than abroad, while foreign paintings tended to be imported when they were of good (enough) quality and attributed to famous artists. To minimize this selection effect, we now focus only on the analysis of attributed paintings, whose distribution across national

<sup>36</sup> Carducho and Nardi were Italians and Orrente visited Italy and was a successful producer of paintings in the style of the Bassano's and Caravaggio. We know that his altarpiece for the cathedral of Toledo was paid 1500 reales in 1617 (Brown 1998, p. 94). As well known, also Velazquez visited Italy.

<sup>37</sup> We know that the initial career of Zurbaran in Seville was problematic: In 1626 he accepted 4000 reales for 21 paintings (while the rival Herrera was paid 900 reales per picture), and in 1630 the guild officers brought him to court for not passing the examination to practice in town. The challenge was dismissed by the council and better commissions did follow (with 2200 reales paid in 1634 for the twelve labors of Hercules). However, the Sevillian market started to decline in the following years. Brown (1998, p. 201) notices that “Zurbaran and his workshop resorted to making devotional pictures for individual clients. Small in scale and simple in composition, these paintings were markedly different from the complex, doctrinal works created for the monasteries of Andalusia.” Nevertheless, the artistic contribution of Seville remained important until the end of the century, also thanks to the success of a drawing academy founded in 1660 by Herrera and Murillo.

<sup>38</sup> According to Brown (1998, p. 98), the causes of the decline of Valencia “are undoubtedly related to the economic consequences of the expulsion of the Moriscos, which would have lessened the appeal of Valencia to painters from the outside. And even if foreign painters had been tempted to try their luck, they would have encountered the resistance of local artists, who were determined to eliminate the competition of foreigners by means of a college of painters. This college was formed in 1607 by a group including Ribalta and Sariñena and was probably influenced by the formation of the *Academia de San Lucas* in Madrid just 3 years earlier. However, the Valencian College can hardly be considered as liberal; like the guild it sought to supplant, it was motivated by a desire to prevent foreign (i.e., non-Valencian) painters from opening up shops in the city.” While entry barriers led to decline in Valencia, it was free entry in the market of Madrid to guarantee the success of its local artists.



**Fig. 3** Price differential between Spanish and Italian school (rolling regression)

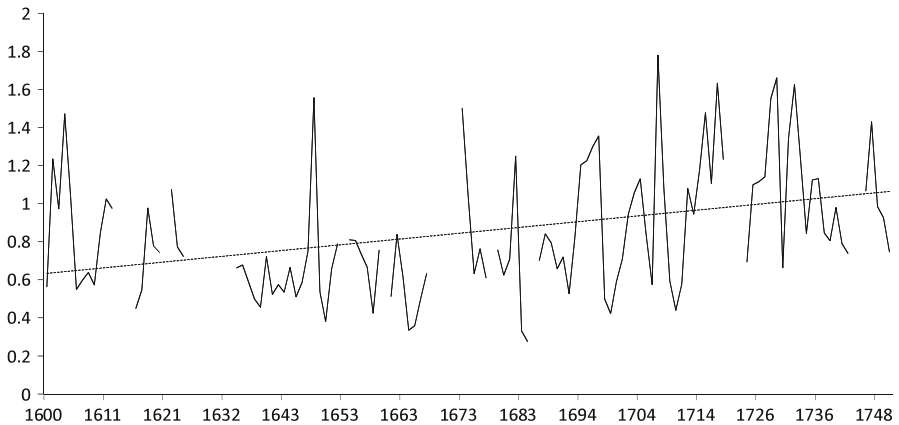
schools was also rather stable over time. In Fig. 3 we report the percentage difference between Spanish and Italian prices on the basis of rolling regressions which compute parameter estimates over a rolling window of a fixed size through the sample (with a full set of control variables). This methodology shows clearly that the price gap between Spanish paintings and Italian ones was extremely large at the beginning of the century, but was gradually eliminated during the development of the Spanish golden age. This price convergence suggests that the increase in the price of paintings may have determined the increase in the quality of domestic production, fostering the artistic innovations of what we now call the *Siglo de Oro* of Spanish art. In the next section we will provide additional support for this.

### 3.3 Domestic versus imported paintings

Our hypothesis that the quality of Spanish paintings, as priced by the market, converged to the quality of the Italian paintings, imported mainly from the Italian territories under Spanish control, especially Naples, faces three possible counterarguments.<sup>39</sup>

The first is that there could be a relative decline in the price of imported paintings for given quality due to variations in the real exchange rate between Spain and Italy. However, the period under consideration was characterized by a slow depreciation of the Spanish real exchange rate due to the continuous flow of American silver which increased Spanish imports and deteriorated the terms of trade. We can confirm this by building a series for the real exchange rate between Madrid and Naples, the main Italian source of imports and, in particular, of paintings. The dataset built by Robert Allen (*Global Commodity Price Database*) provides the annual price of wheat in grams of silver for both Naples and Madrid, and their ratio, shown in Fig. 4, is our best measure of the relative prices in Italy compared to Madrid. The increasing pattern confirms, if anything, that relative prices increased in Italy compared to Spain, and the

<sup>39</sup> We are very grateful to two anonymous referees for pointing out the three issues addressed below.



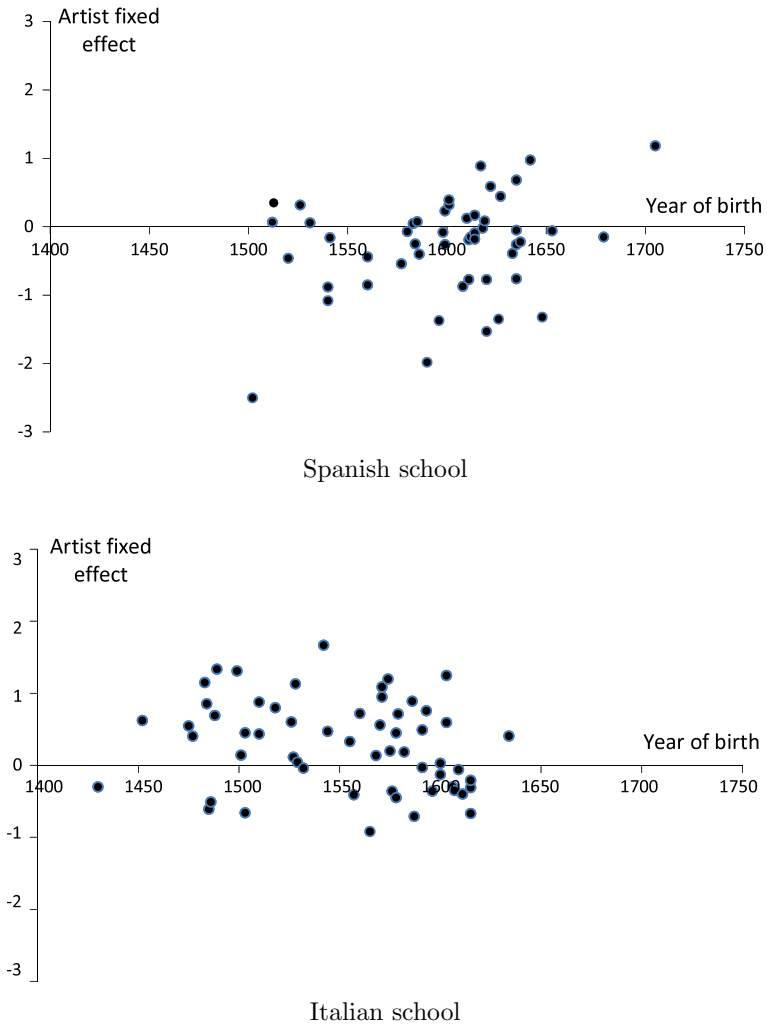
**Fig. 4** Real exchange rate:  $\frac{P_{Italy}}{P_{Spain}}$ . Based on the cost of 1 l of wheat in grams of silver in Madrid and Naples. *Source:* the dataset built by Robert Allen—Global Commodity Price Database

real exchange rate depreciated in Madrid during the century. As long as this was associated also with an increase in the real price of imported paintings compared to the domestic ones, it did work against price convergence.

The second issue is that there could be a relative decline in the quality of imported paintings, which could explain part of the mentioned convergence in prices. Changes in international economic conditions and in trade barriers (increasing ease of importation as trade routes and transportation become better developed) may have attracted larger imports of paintings of lower quality and price. Our hedonic regressions already control for the quality characteristics priced in the secondary market, but there could be an indirect bias due to a gradual change in the quality composition of domestic and imported paintings in the inventories. A way to get some indirect evidence on this point is by investigating whether there is a much larger set of Italian artists represented in the latter parts of the sample: This is actually not the case, since the relative contribution of Italian paintings in the inventories remains substantially stable (almost half of the attributed paintings) or even declining compared to the Spanish paintings (which were about a third of the attributed paintings).

The third counterargument to our hypothesis is that the convergence between prices of domestic and imported paintings may be due to an increasing demand and preference for (both old and contemporary) Spanish art (an emerging home bias of Spanish collectors) rather than because of an increasing quality supplied by the new emerging Spanish artists. To discriminate between these two alternative hypothesis, our final test is run looking only at Spanish and Italian painters and using additional information on the year of birth of the painters.<sup>40</sup> Figure 5 shows the fixed effects of Spanish and Italian artists in relation to the year of birth on the basis of our main

<sup>40</sup> We include Ribera between the Spanish painters to increase the number of observations in the corresponding regression. This does not affect our results.



**Fig. 5** The fixed effects of Spanish and Italian artists in relation to the year of birth

hedonic regression (2) of Table 2. While a visible increasing pattern emerges for the domestic painters, the cloud of fixed effects for the Italian painters does not appear to be positively correlated with the cohort of birth. This suggests that new domestic painters were indeed producing increasing quality as priced by the market, while the quality of the new imported paintings as priced by the market did not change.

In Table 4 we test formally our hypothesis focusing on the two separate subsets of painters and controlling for the date of birth of painters. The regression run on attributed Spanish paintings confirms the positive relation between price and year of birth of the painter: This supports the idea that it was the quality of new Spanish

**Table 4** Price regressions for paintings of Spanish and Italian schools

	(1)		(2)	
	Spanish school		Italian school	
Year	0.221***	(0.057)	0.023***	(0.002)
Date of Birth	0.214***	(0.060)	−0.005***	(0.001)
Interaction of Date of Birth with Year	−0.00013***	(0.00003)		
Work sold 1–5 years after death	0.325**	(0.143)		
Work sold 6–10 years after death	0.267	(0.176)		
Copy	−0.773***	(0.137)	−1.369***	(0.100)
Unknown genre	Omitted		Omitted	
Figurative	0.953***	(0.267)	1.005***	(0.213)
Genre	0.353	(0.368)	0.556**	(0.247)
Landscape	0.281	(0.300)	0.253	(0.265)
Portrait	0.696**	(0.274)	0.581**	(0.230)
Still life	−0.0201	(0.280)	1.091***	(0.350)
Surface area (s) unknown	Omitted		Omitted	
$S < 0.5$ square meters	−0.243*	(0.136)	−0.522***	(0.158)
$S \in (0.5, 1)$ square meters	0.019	(0.132)	0.188	(0.143)
$S \in (1, 1.5)$ square meters	0.300*	(0.163)	0.163	(0.140)
$S \in (1.5, 2)$ square meters	0.627***	(0.214)	0.346*	(0.181)
$S \in (2, 3)$ square meters	0.891***	(0.180)	0.444***	(0.171)
$S \in (3, 4)$ square meters	0.977***	(0.241)	1.024***	(0.284)
$S > 4$ square meters	1.327***	(0.229)	1.698***	(0.220)
Canvas	−0.201*	(0.104)	0.146	(0.105)
Lamina	0.735**	(0.295)	0.154	(0.252)
Wood	−0.003	(0.250)	−0.057	(0.155)
Nr. paintings evaluated	−0.129***	(0.023)	0.038*	(0.022)
Golden frame	−0.289***	(0.092)	−0.517***	(0.088)
Black frame	−0.067	(0.091)	−0.320***	(0.107)
Noble collector	0.762***	(0.091)	0.622***	(0.092)
Constant	−360.2***	(96.41)	−22.79***	(2.565)
Observations	780		938	
Adjusted ( $R^2$ )	0.50		0.52	

painters entering in the market (and in the collections) that was increasing along the century, and not the general preference for Spanish art.

The interaction with the time trend also shows that this effect was stronger at the beginning of the period and was gradually reduced during the century: Reading the coefficients properly, one finds that painters born in 1580 (active since the beginning of the XVII century) will be paid 10 % more than painters born a decade earlier, but 9 % less than those born a decade later, and prices will continue to increase for new domestic painters with the highest payments for the works of



Spanish painters born in the 1640s (as Claudio Coello) and therefore active in the very last season of the *Siglo de Oro*. The regression run on attributed Italian paintings confirms the positive trend over time and delivers a negative but extremely small coefficient on the year of birth of the painters: There is no evidence that the quality of Italian paintings as priced by the market changed in an economically significant way for the most recent painters. In other words, the main quality improvements perceived by the markets were those of the new Spanish painters. In the absence of precise data on repeated sales and on the exact years of execution of the paintings in our dataset, this is the most reliable evidence we can provide on the convergence of domestic quality to the imported quality.

Within the last specification for paintings attributed to local artists we have also tried to detect evidence for a “death effect” (see Ursprung and Wiermann 2011). We controlled whether prices were increasing in the immediate years following the death of a Spanish painter (we did not perform the same analysis for Italian painters because news about the death of painters active abroad were too rare and even unlikely to spread quickly enough to affect the market). The data emphasize that in the art market of Madrid there was a price increase for the works by Spanish painters right after their death. We do not want to overemphasize such evidence of a death effect, given the limited number of observations (around the year of death),<sup>41</sup> but these results appear to suggest that paintings’ evaluations in the Spanish Baroque age were already sensitive to new information on the activity of the local artists.

## 4 Conclusion

We have analyzed art pricing in a unique dataset on Madrid inventories of the Baroque period. The hedonic price index for all the paintings has shown an increasing pattern during the XVII century, but domestic paintings were priced below imported ones at the beginning of the century. This price gap was gradually eliminated during the century and prices increased, especially for the new local painters, reflecting the artistic innovations of the Spanish *Siglo de Oro*.

In future research it would be interesting to investigate the aggregate causes of the increase in art prices taking into account both demand and supply effects. The Lopez hypothesis suggests that the loss of investment opportunities associated with economic crisis can increase the demand of art by the aristocratic upper-class. This tends to increase prices if the impact on supply of paintings is limited. If this was the case in Baroque Madrid, a causing factor of its artistic dynamism was, paradoxically, its economic stagnation.

Moreover, we should distinguish these patterns from what would happen in more dynamic economies with an emerging middle class as the Dutch economy of the XVII century or the British and French economies of the XVIII century: There,

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<sup>41</sup> Ten percent of the observations are for evaluations taking place within 5 years from the death of eleven Spanish painters (including Diego Velazquez, Pedro Orrente, Vicencio Carducho, Manuel de Molina and Ribera).

increasing demand for paintings would derive from the growing bourgeoisie and this will attract both new painters and artistic innovations.

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