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Assessing Quality in Cultural Goods: The Hedonic Value of Originality in Rembrandt's Prints

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Abstract. The definition of quality, and its consistent assessment, is a fundamental issue when dealing with collectibles. We analyze how originality is priced by the market. The market for prints by Rembrandt is considered. An original database has been built including almost 5,000 transactions in the international auction market during the period 1985–1998. The data allow us to control for many different characteristics (market, aesthetic, originality, authenticity, rarity, art history, techniques, conservation, etc.). The concept of "state" is used to measure originality. In printmaking a state is defined as the artist's creative phase, which occurs on the plate before inking and printing. We test whether (non-original) posthumous states are sold at prices lower than Rembrandt's own (original) states. The implicit price associated with the state has been found to significantly decrease if the state was later printed by someone else when it was no longer the master's intervention on the plate. Furthermore, a decreasing value among subsequent original states has proved to positively account for Rembrandt's direct invention.

Key words: art markets, Old Master prints, originality and rarity

JEL classification: Z11, D46, C52

1. Introduction

The definition of quality and of its components, such as originality, is a fundamental problem when dealing with cultural assets and collectibles. From an economic perspective, it is relevant to investigate whether (and what type of) a relationship exists between market valuation – given by prices – and quality. In order to do this, a measurement of quality is needed.

The problem of quality may be approached from a variety of perspectives. Greffe (1999) and Throsby (2001), among others, describe the different components of quality or cultural value, and summarize existing methods to value it for analytic and policy purposes. Aspects like aesthetic or artistic value, originality, authenticity, rarity, symbolic and historical values, and so on, are distinguished. Empirical analysis, like that of Ginsburgh and Weyers (1999), focuses on quality of movies, and compares different perceptions of quality, such as experts' appraisals. De Marchi and Van Miegroet (1996) value one aspect of quality, originality, by comparing historical prices of Old Flemish paintings and their copies, and trying

to explain why they differ. Copies of artworks as such, distinguished from fakes, are analyzed by Benhamou and Ginsburgh (2002), recognizing the positive role (diffusion, education, preservation, etc.) they can play in art markets.[1]

Originality and copies represent an important issue in the arts, in art markets, and in the cultural sector as a whole (Schwartz, 1996). Attribution is one of the activities that has so far occupied many art historians. From a market point of view, originality is expected to bear an intrinsic value, since a copy is generally less valued than its original. Owners of works of art, dealers, experts, lawyers and courts are quite busy certifying the originality of artistic goods. Cultural policy makers and museum directors, responsible for valued historical buildings, sites and artistic objects, are faced with the dilemma of preservation against sustainability, which sometimes leads to substituting (expensive) copies for originals.

This study is a contribution to the development of the analysis of originality, and to possible ways to measure it and its market impact, given the other quality attributes. Originality is close to aesthetic value, because it takes into account the artist who first expressed the idea. Authenticity (such as signatures and date) is different from originality, but it provides informative support and proof of originality. Rarity merely relies on quantitative availability, which depends on stocks, demand and preservation. Conservation affects preservation and, ultimately, the enjoyment of aesthetic quality.

Originality deals with creation and accounts for invention and innovation. But how can one "measure" originality? How much less original is a copy than its model? How can one weight its impact? In order to answer these questions, a particular type of artistic good will be analyzed: Old Master prints.

Old Master prints were usually made from (copper or other metal) plates. In the past the artificial restriction of limited edition and plate destruction was not in use at all. On the contrary, the use of plates virtually depended only on physical constraints. This might have eventually required some changes in order to refresh the plate, and resulted in a sequence of states.

In printmaking – especially in the case of techniques such as etching, engraving and drypoint – a state is defined as the artist's creative phase which occurs on the plate before inking and printing. A printed state is a technically-induced *modus operandi* that "takes a picture" of the different phases of the creative process. Further states can be the result of correcting for mistakes, making changes, and/or achieving completeness (Hinterding et al., 2000: 115), but they can be brought on by non-artistic reasons as well: art historians such as Schwartz (1998) and Luijten (2000: 21), for example, believe that Rembrandt created further states in order to satisfy or create extra demand among his "avid collectors." In general, his plates represented a "business capital he relied on," that is a source of product differentiation he could use in order to increase demand. Each plate could be modified several times, thereby generating a variable sequence of states.[2]

The point is that plates, as such, constituted an asset also suitable to be sold or given away and to be further exploited by someone other than the original

artist through the printing of additional sheets. This circumstance leads to our main concern: how are these extra, posthumous prints valued in the market in comparison to original ones?

For centuries prints have carried innovation much more than painted copies.[3] In the absence of museums, exhibitions, catalogues and posters, prints have essentially contributed to the spreading of styles across the world (Van de Wetering, 2000: 36). Great artists, such as Mantegna, Dürer, Raphael, Rembrandt, and later Goya, Tiepolo, up to the moderns, like Munch and Picasso, have practiced this medium extensively either alone, mastering all production phases, or with the assistance of highly specialized teams of professional engravers, printers and editors (Griffiths, 1981).

The artistic power of prints, together with their enormous diffusion potentialities, was rapidly noticed by Rembrandt Harmenszoon van Rijn (Leiden 1606 – Amsterdam 1669).[4] He became acquainted with Italian and even Dutch (in particular those who had emigrated from Spanish-occupied Flanders) artists through reproductive prints. In fact, when Rembrandt was advised to go and study in Italy, he refused, because he thought that enough art could be seen (and learned) in Holland. He, in turn, spread his own art through prints. In printmaking – and not only in this artistic domain – Rembrandt represents a milestone. "Except for Dürer, European art knows no artist so extensively occupied with graphic activity as was Rembrandt. . . None of the artists of the 17th century pursued the farthest potentialities of this complex technique so completely as did Rembrandt. None succeeded in achieving so much variation in black and white" (Boon, 1963: 9).

Rembrandt constitutes a reference in terms of states, since already fifteen catalogues have been dedicated to him and his states. Master of all creation phases (Griffiths, 1996: 56–65, 153), he developed an innovative style, mastering and inventing composition and production techniques. In particular, he was able to obtain an incredible degree of variation through the multiplication of states, a result that was amplified by the inking process and the choice of particular papers (Griffiths, 1981: 135–158; 1996: 76). One of Rembrandt's etched masterpieces, *The Three Crosses*, represents the Old Master print that best illustrates this variation in states; indeed, for a long time, experts thought that the four states had been edited from two different plates (Salamon, 1986: 90–91).

Nowadays, collections of Rembrandt's prints constitute a treasure in the main European and North American museums, print cabinets and libraries.[5] The difference between the truly complete collection in the British Museum, and the almost complete collection held by the Rijksmuseum is . . . one (first) state only![6]

The great success that Rembrandt achieved in printmaking attracted not only admirers, but also imitators, who tried to replicate his expertise. The luckiest ones could exercise themselves directly on the plates that survived the artist, causing an increase in states. For centuries this phenomenon has been the object of intense study, and still affects the complex process of attribution.

We will employ states as a measure of originality and invention. Rembrandt's original states will be compared with posthumous (therefore non-original) states. The main assumption of a decrease in price for the latter will be tested. Other aspects related to quality will be taken into account as well, such as aesthetic value, rarity, authenticity and conservation status. Thus, the characteristics considered here are not only concerned with the "inherent" quality of the differentiated goods (Griliches, 1961, 1971), but also with certain aspects of the transaction in which they have been involved (e.g., which auction house operated the transaction).

Given the heterogeneity of characteristics, a hedonic approach will be used. After various contributions to the theory and technique of this analysis (see, in particular, Lancaster, 1966; Rosen, 1974; Palmquist, 1984), Frey and Pommerehne (1989: 81–100) applied hedonic regression to price artistic quality and its specifications.[7] Hedonic analysis has also been employed to analyze artistic goods with the aim of constructing price indexes (Chanel et al., 1996). Unlike the studies of Goetzmann (1993) or Pesando (1993), this paper does not rely on repeat sales, since it does not deal with the resale of unique items (paintings), or with the sale of practically identical multiple goods (modern prints).

This paper is organized as follows. In Section 2, we present our database. Section 3 illustrates a general model of prices of prints explained by originality and other characteristics. In Section 4 the main regression results concerning originality and rarity are presented and discussed. Section 5 concludes the paper.

2. Database Description

Data were collected from pre-sale catalogues and sales bulletins of twenty-one auction houses around the world, essentially Europe and North America. Information about states and other artistic and quality characteristics, as well as collecting history, was integrated with these data using various art-history catalogues on Rembrandt and printmaking manuals,[8] making for a unique data set.

The data include 4,705 observations of sales of Rembrandt's prints on the international market between 1985 and 1998. Prices comprise the buyer's premium.[9] They are expressed in US$, and corrected for inflation (base = 1995).

In these sales, 260 titles appear while 309 were produced and are recognized as being by Rembrandt. Table I gives some descriptive statistics. Prices range from a minimum of $83 to a maximum of $1,172,279. The median is $3,510, while the mean is $11,522. Yearly average world turnover in the sample is $3,872,046.

Note that a title and a state correspond to each print. To each title corresponds one plate, and *vice versa*. For each title a (usually known) number of one or more states exists, depending on the subsequent changes added to the plate. Each state can be pulled in a variable (usually unknown) number of copies or prints.

If a last state is pulled in extra copies by someone other than the artist, we obtain later prints. Furthermore, the generic "state" (either original or posthumous)

Table I. Descriptive statistics

Variable	Median	Mean	Std Dev	Minimum	Maximum
Price (US$)	3,510	11,521.50	43,436.98	83	1,172,279
"State"/Number of states	1	1.130	0.576	0.125	8
"State" – Number of original states	0	0.144	0.914	−7	7
Number of original states	2	2.176	1.361	1	10
Number of posthumous states	2	1.882	0.385	0	7
Year of production	1641	1642.083	8.960	1626	1665
No. of transactions (per title)	16	18.096	11.071	1	91
Year of transaction	1991	1991.282	4.075	1985	1998
Surface (cm^2)	163	258.262	330.128	13	2,627

reported in sales catalogues does not always explicitly mention whether the state is original or posthumous, a distinction which is, instead, within connoisseurs' reach. For a given title, states by Rembrandt might possibly have been followed by a variable number of posthumous states when the plate was reworked by someone else than Rembrandt after his death. In addition, traditionally attributed original states may be the object of reattribution as non-original states. Therefore, for our dataset we have also used art history catalogues on Rembrandt's prints also to explicitly distinguish original from posthumous states.

For a given title, therefore, one can encounter only originals; original states and later prints; or original, posthumous states and later prints. The total number of states Rembrandt attained for each title, and the total number of posthumous states for each title are also displayed in Table I. State by Rembrandt refers to the state number of a given print, and, by definition, it cannot be higher than the total number of states by Rembrandt of the title in question.

In the sample the total number of original states varies between 1 and 10, with a median of 2. The total number of posthumous states varies between 0 and 7, also with a median of 2. An original print is distinguished from a posthumous one on the basis of the total number of original states and its specific state.[10] We can express this relationship either as a ratio, "state"/total number of original states, or as a difference, "state" – total number of original states. When this difference is strictly positive, it corresponds to posthumous states.[11] Notice the presence of a slight majority of posthumous states, that is a ratio >1, and a difference >0. Among Rembrandt's states, last states are predominant. Last states can also be later prints. This leads us to take into consideration scarcity or rarity characteristics as well.

Figure 1 plots prices against ratios. Original states belong to the interval (0, 1], and posthumous states to $(1, \infty)$. Originals, which occupy the left-hand portion, obtain higher prices than posthumous states. Note that if the ratio equals one, we have (original) last states (e.g., I/I, II/II, III/III, etc.). The relatively high concentration of observations at this point is due to the large number of unique states

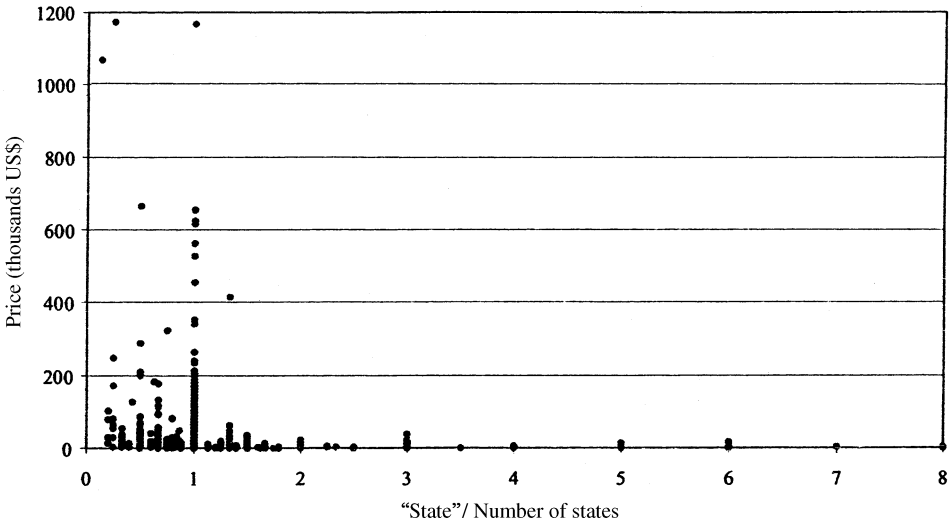

Figure 1. Original vs. posthumous states.

(I/I) and of last states in general. Unique states or additional states might be due to creative reasons (the artist was satisfied with the first one and stopped, or instead, decided to go further) and/or because of the presence/absence of demand for further or differentiated prints. The relatively high proportion of last states in the sample may also be due to the scarcity of previous states in today's market.

These preliminary remarks about the data, the heterogeneity of states, and their implications with respect to quality and demand, lead to the introduction of the model.

3. The Model

A hedonic regression model is employed, in which log-prices of Rembrandt's prints are explained by a set of characteristics. The general model is:

$$\ln\ p_i = \alpha + \sum_{j=1}^{m} \beta_j s_{ji} + \sum_{k=1}^{r} \gamma_k x_{ki} + u_i$$

where $\ln p_i$ is the log of the price of a print i, the s_{ji} are variables defining different aspects of states or originality, the x_{ki} are other control variables, and u_i is the error term, with $i = 1, \ldots, n$; $j = 1, \ldots, m$; $k = 1, \ldots, r$.

We test the main hypothesis that, given the other characteristics of the print (i.e., subject, dimensions, date, transaction details, state of conservation, etc.), and in particular its rarity, originally printed Rembrandt's states are more precious than later prints, which are in turn more precious than posthumous states.

What follows is a description of single or groups of independent variables (in bold) employed for originality and rarity. The Appendix provides a description of the remaining controls that are also included in the model and define aesthetic value, authenticity, conservation status and others.

3.1. ORIGINALITY

Originality is fundamentally expressed by original states as opposed to posthumous states. The main assumption is that original states are more valuable than posthumous ones.

State. A single group of dummies has been built combining the following aspects (in italics) of originality expressed through states, which are associated with a single print or its related title.

Total number of states produced by Rembrandt. This characteristic refers to the title and represents the total number of original states. The number of states depends on both budgetary and aesthetic reasons. For example, model studies (that is, depicting human figures) were usually completed by the artist in three states (Hinterding et al., 2000: 96). If the engraving phase was elaborated, the production costs necessitated the printing of many copies, as in the case of the famous *The Three Crosses*, and *Christ Presented to the People* (Hinterding et al., 2000: 303, 318).

Rembrandt's state. This refers to the original state number of a given issue, which, by definition, cannot be higher than the total number of states by Rembrandt for a given title.

Last original state. Any plate in its last state could potentially have generated later prints by other printmakers than the master, or even posthumous states. Therefore, a last state is a turning point between originality and non-originality. For a given title, a last state can be a first state if the total number of original states is one, a second state if the total number of original states is two, and so on. Last states might bear some attribution uncertainty, because of the possibility of being followed by later prints or even posthumous states, despite any (known) history of their plate.

Later print. When the plate in its final state by Rembrandt was passed on to somebody else and reused to produce new prints, we have a later print. Potentially, each last state can become a later print. A later print should be of lesser value than an earlier one.

Posthumous state. When the plate in its final state by Rembrandt was reworked by someone else's hands to generate new states, the print is no longer original but posthumous. In order to conveniently order and, to some extent, compare posthumous states, we define the posthumous state to be the difference between the general "state" (either original or posthumous) as defined in Section 2, and the total number of states by Rembrandt. For example, if a given print is of "state" 2 over a total by

Rembrandt of 1, we have a first posthumous state; if "state" is 5 over 3, we have a second posthumous state, etc.[12]

History of the title originality. Dummies have been created by combining the characteristics above with the history of the title in question (from the sample and the history of Rembrandt's prints). Any print (in the context of its title) may have been followed by: (a) only originals; (b) originals and late prints; (c) or originals, late and posthumous prints. A print that was followed by originals only does not pose attribution and originality problems, but then again the title was possibly not too interesting or successful either, and therefore its plate was never later printed or reworked.

The control for this whole group of dummies is posthumous states >1. The main assumption is that the bigger the distance from a posthumous state >1, the more valued a print will be.

Number of posthumous states. This variable is defined in the same way as the number of states by Rembrandt. Assumptions about this variable are contradictory, as with the history of the title originality, since there are effects that go in both directions. More posthumous states mean that the title is successful, and this has a positive effect on its prints. But there is also a negative effect, given by a higher risk to find posthumous prints on the market.

Later printer known. This dummy refers to whether or not the later printer is known.

Posthumous reworker known. Defined in the same way as the previous variable, this dummy takes the value of 1 when the posthumous reworker is known. As explained for the history of plate collection, knowing the identity of a posthumous reworker, or of a later printer, may negatively affect the price.

History of plate collection. Rembrandt eventually sold some of his plates, and in any case most of them survived his death (Hinterding, 1993–94). From the second half of the 18th century on, when Rembrandt was again in demand, the original plates ended up in the hands of collectors and printmakers, such as Daulby (1796), Bartsch (1797) and others. After the production of later prints (from original, not reworked plates), there began a "proliferation of states" (Luijten, 2000: 22). The main reasons were aesthetic and creative imitation, emulation or apprenticeship, or a speculative attempt to increase the initial stock (to satisfy higher demand).

A group of three dummies refers to the history of plate ownership after Rembrandt: we distinguish between the collector and remaker Basan (and quite a continuous line of collectors and print-lovers who, after his death, acquired and transferred his collection of Rembrandt's plates); others; and plates which for all practical purposes disappeared with Rembrandt (the control). The idea behind this group of

variables is that, if a plate was owned after Rembrandt, it potentially could have been reworked, and should therefore negatively affect originality, and thus price. This is especially expected for Basan, who is known for having often reworked, and in some cases altered, the plates in his possession.

Despite the fact that many plates still exist today, this information will not be included as a variable in the regressors for several reasons. First, plates that still exist merely represent a symbolic and knowledge value rather than a real danger of an increase of posthumous states. Second, when a plate still exists, this fact is highly correlated with the independent variables that represent Basan and other collectors, because only a limited number of plates either survived almost untouched, or presumably disappeared with Rembrandt's death (Hinterding, 1993–94: 288–303).

3.2. RARITY

Market rarity derives from four main factors: initial demand, production technology constraints, environmental factors, and heritage preservation. According to Griffiths (1996: 152) rarity "has nothing to do with the quality of a print, although it may increase interest in it." Salamon (1986: 108) considers that the rarest states of Rembrandt are quite well known and are nowadays out of the market, preciously kept in a few museums in the world.

Unlike modern techniques (lithography, off-set, etc., for which limited editions are artificially conceived) and steel plates (introduced in the 1820s and allowing for steeling method), ancient techniques on copper plates such as etching, drypoint and burin (engraving) only produce a limited number of prints. In terms of good prints, Salamon (1971: 84) estimates that with drypoint at most 30 good prints can be produced,[13] with etching some 100 to 200, and with burin a few hundred.[14] In more general terms, Griffiths (1996: 38–39) sets the overall maximum to three thousand issues per plate.

Rarity is not necessarily related to first states. For example, the rarest state of *Christ Presented to the Temple* is the sixth one (Hinterding et al., 2000: 320, 347). Salamon (1991: 13) points out that sometimes "the first state is with no doubt less rare than the second one."

At the time of Rembrandt limited editions did not exist, and the master was ready to satisfy any new demand for his prints, for which he created variations. On the other hand, climatic conditions (humidity, etc.), environmental accidents (such as physical destruction), careless handling and loss are quite relevant for the survival of a delicate and fragile support such as paper. Finally, heritage preservation also limits the stock circulating on the market.[15]

As for originality, rarity is expected to have a positive effect on prices. We shall use two main alternative definitions of rarity, the relative number of transactions and historical rarity. The other variables – existence of proofs and rarity of the first state – are complementary to the second definition.

Relative number of transactions. This first variable refers to the proportion of transactions concerning a given title taking place over the period 1985–1998.

Historical rarity. Nowell-Usticke (1967) tried to provide a systematic classification of rarity for Rembrandt's prints. He based this on 20 years of observing sales in London. Since sales of important collections happened a few decades earlier (Salamon, 1971: 207–256), these estimates should be considered reliable; and even if the catalogue was compiled before Nowell-Usticke's sale of his own rich collection of Rembrandt's prints, it is regarded as the only reference for rarity. For each title we have adopted his six classifications of rarity: greatest rarity (3–25 prints existing), very rare (30–50), rare (50–70), very uncommon (75–125), uncommon (125–225) and commonest (225–500). Uncommon and commonest prints are set as control.

Rarity of the first state. On the basis of some attempts to estimate the rarity of different states of the same title,[16] this dummy takes into account the rarity (and non-rarity) of first states.

Existence of proofs. Nowell-Usticke (1967: 28) defines trial proofs as "the early impressions, usually taken to study the print to see if any alterations were necessary before commencing with the regular printing. Of course, if no alterations are made, trial proofs cannot be distinguished from first states." According to Nowell-Usticke (1967: 14), "Rembrandt was basically a one state etcher." He estimates that the artist used to print 5 trial proofs plus 20 first-state issues. If they sold well, another 25 to 50 prints were issued. Nowell-Usticke also distinguishes between early, intermediate and late prints, concluding that Rembrandt would probably not have issued late ("worn") prints. In terms of rarity, the existence of proofs should negatively affect the price, but in terms of quality the opposite should hold.

4. Regression Results: Originality, Rarity (and Uncertainty)

The data were divided into four sets according to the total number of states produced by Rembrandt for a given title: only one state, only two states, only three states and more than three states. These four sets were employed in four separate regressions. This results in important advantages in terms of originality definition and interpretation.[17] In fact, a higher homogeneity in sample data allows a direct comparison of the prices of originals with those of their posthumous states. Some homogeneity is also obtained for posthumous states. Remember that the adopted definition of posthumous state is indifferent to the problem of variation of the total number of original states across titles. In a pooled regression it is more difficult to distinguish between, say, a unique state and a first state followed by other states.[18]

The results concerning originality and rarity are presented in Tables II–IV. The remaining results that we obtained concerning the impact of other control variables

Table II. Regressions results: States and originality of Rembrandt's prints

Dependent variable: ln (price)	Only 1 state (1)	Only 2 states (2)	Only 3 states (3)	More than 3 states (4)
ORIGINALITY				
State:				
1st state, possibly originals followed[a]	1.162** (0.154) 182	1.185** (0.350) 9	Omitted observations	Omitted observations
1st state, late prints followed	1.165** (0.151) 267	1.844** (0.321) 11	No observations	No observations
1st state, posthumous states followed	1.162** (0.110) 601	1.681** (0.197) 234	2.078** (0.266) 29	2.975** (0.473) 8
2nd state, possibly originals followed[a]		1.212** (0.232) 129	0.736* (0.497) 27	Omitted observations
2nd state, late prints followed		1.237** (0.241) 53	1.835** (0.490) 7	No observations
2nd state, posthumous states followed		1.045** (0.187) 756	1.441** (0.388) 129	2.294** (0.312) 19
3rd state, possibly originals followed[a]			1.256** (0.302) 31	1.854 (0.953) 6
3rd state, late prints followed			0.782* (0.351) 42	No observations
3rd state, posthumous states followed			0.987** (0.195) 289	2.131** (0.287) 18
4th & last state, nothing else followed				1.046 (0.830) 19
>3rd & last state, late prints followed				-1.122 (2.153) 7
4th & last state, posthumous states followed				1.155** (0.228) 105
4th state, posthumous states followed				0.940** (0.323) 20
>4th & last state, nothing else				1.568 (0.904) 19
5th & last state, posthumous states followed				0.620 (0.335) 32
>4th state, nothing else followed				0.517 (0.865) 9
>4th state, posthumous states followed				1.143** (0.297) 19
6th & last state, posthumous states followed				0.978** (0.368) 22
>6th & last state, posthumous states followed				0.618* (0.268) 29

(Continued on next page)

Table II. (*Continued*)

Dependent variable: ln (price)	Only 1 state (1)	Only 2 states (2)	Only 3 states (3)	More than 3 states (4)
Late print, only late prints followed	0.588* (0.236) 18	Omitted observations	Omitted observations	Omitted observations
Late print, posthumous states followed	-0.198 (0.123) 237	0.381* (0.192) 274	0.405 (0.209) 152	(see below)
Late print of 4th state, posthumous states followed				0.819* (0.324) 15
Late print of 5th to 6th state, posthumous states followed				0.138 (0.403) 12
Late print of 8th state, posthumous states followed				0.021 (0.303) 14
Posthumous state 1	0.349** (0.108) 210	0.472** (0.182) 174	0.517** (0.375) 59	0.718** (0.165) 57
Posthumous state >1	0.000 158	0.000 23	0.000 53	0.000 104
Intercept	6.737** (0.229)	5.840** (0.286)	6.700** (0.515)	6.147** (2.065)
No. of observations	1,673	1,663	818	534

Notes. Standard errors are reported in parenthesis. ** Denotes results significantly different from 0 at 99% level, * denotes those at 95% level. For dummy variables a smaller font indicates the number of observations. Up to 3rd states, when the number of observations for a given state was smaller than 5, those observations were omitted from the dataset. From 4th states on, states for which there were not enough observations, were grouped together. For the group of dummies defining State, the control is Posthumous state >1.
[a] Except if last state.

Table III. Regressions results: Originality (continued) and rarity of Rembrandt's prints

Dependent variable: ln (price)	Only 1 state (1)		Only 2 states (2)		Only 3 states (3)		More than 3 states (4)	
ORIGINALITY (continued)								
Number of posthumous states	0.026	(0.022)	0.097**	(0.022)	0.022	(0.086)	-0.230	(0.181)
Later printer known	0.055	(0.136)	-0.072	(0.121)	-0.033	(0.158)	-0.093	(0.299)
Posthumous reworker known	-0.529**	(0.125)	-0.320*	(0.134)	-0.121	(0.232)	-0.355	(0.269)
History of plate collection:								
Basan	-0.285*	(0.141)	-0.075	(0.148)	-0.633	(0.360)	-0.725	(0.630)
Other owner(s) known	-0.029	(0.117)	-0.041	(0.126)	-0.607	(0.418)	0.762	(0.629)
Only by Rembrandt	0.000		0.000		0.000		0.000	
RARITY								
Historical rarity:								
Rarest	1.053**	(0.211)	1.705**	(0.302)	1.669*	(0.733)	-0.096	(1.440)
Very rare	0.130	(0.137)	0.052	(0.191)	-0.655	(0.484)	-2.079**	(0.713)
Rare	0.188	(0.111)	0.880**	(0.105)	-0.0004	(0.471)	-1.365*	(0.535)
Very uncommon	-0.020	(0.108)	0.527**	(0.098)	0.205	(0.436)	-0.690	(0.782)
Common and commonest	0.000		0.000		0.000		0.000	
1st state rare	-0.109	(0.239)	-0.118	(0.343)	-0.504	(0.594)	Omitted variable	
Existence of proof	0.063	(0.146)	0.250**	(0.075)	0.551*	(0.232)	0.511	(0.365)
OTHER TYPES OF CONTROL INCLUDED:								
AESTHETIC VALUE				Yes[a]				
AUTHENTICITY				Yes[a]				
CONSERVATION STATUS				Yes[a]				
AUCTION HOUSES				Yes[a]				
MARKET TRENDS				Yes[a]				
R^2	0.657		0.647		0.665		0.785	
Adjusted R^2	0.631		0.620		0.610		0.718	
F Value	25.88		23.74		12.10		11.77	

Notes. Standard errors are reported in parenthesis. ** Denotes results significantly different from 0 at 99% level, * denotes those at 95% level. For each group of dummies the control is reported, while controls of single dummies are not specified. 1st state rare was omitted in the fourth regression due to collinearity bias.

[a] Results are available from the author on request.

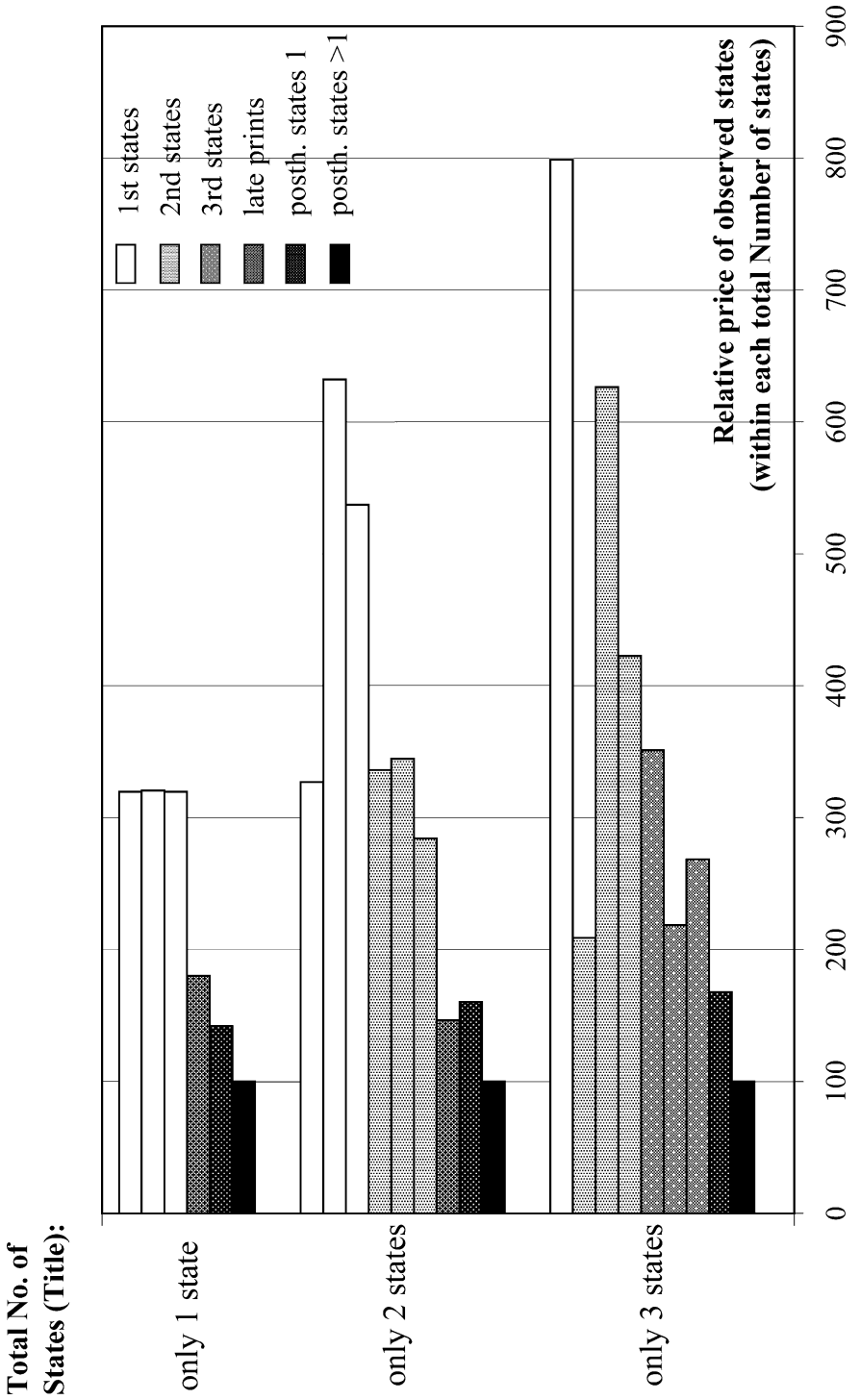

Figure 2. Relative prices of prints (states >1 = 100).

Table IV. Testing differences in prices between states

H_0:	F value
Regression 1: Prices are not significantly different between 1st states[a]	0.01
Regression 1: Prices are not significantly different between late prints and posthumous states	15.06**
Regression 2: Prices are not significantly different between 1st states[a]	1.56
Regression 2: Prices are not significantly different between 2nd states[a]	1.09
Regression 2: Prices are not significantly different between late prints and posthumous states	3.54*
Regression 3: Prices are not significantly different between 2nd states[a]	2.44
Regression 3: Prices are not significantly different between 3rd states[a]	0.74
Regression 3: Prices are not significantly different between late prints and posthumous states	3.60*
Regression 4: Prices are not significantly different between 3rd states[a]	0.08
Regression 4: Prices are not significantly different between last states[a]	1.17
Regression 4: Prices are not significantly different between late prints and posthumous states	5.26**

Notes. F value $= \frac{(RSS_R - RSS_U)/(DF_R - DF_U)}{RSS_U/DF_U}$, where RSS_R is the residuals sum of squares of the restricted model, RSS_U is the residuals sum of squares of the unrestricted model, DF_R and DF_U are the degrees of freedom of, respectively, the restricted model and the unrestricted model. H_0 (no differences in prices) is rejected at 1% (**) or 5% (*) significance if $F > F^*$, where F^* is the tabulated value for $(DF_R - DF_U)$ and DF_U.

[a]Whether they are followed or not by late prints and/or posthumous states.

(aesthetic value, authenticity, etc.), are briefly discussed in the Appendix. In each table, columns (1) to (4) show the results for each of the four regressions.

Table II displays the main results for originality described by states. For a given title, every observed xth state was respectively followed only by originals (unless it was a last state[19]), or by late prints but not by posthumous states, or by late prints and posthumous states. The control used for the state dummies is posthumous state >1, that is the posthumous states for which the difference between the title number of original states and the observed state is >1 (e.g., III/I, VI/II, VI/III, etc.).

After having controlled for rarity, our main conclusion is that, in general, original states are more expensive than later prints and posthumous states. Furthermore, among original states, we can notice an overall price decrease as the number of states increases. Note, however, that the relative differences in price between originals and non-originals are not always as large as one might expect. Originals can, in fact, be worth up to three times more than posthumous states >1, if their titles were developed only in one state (column (1)). On the other hand, when titles include three or more states, their original prints can fetch prices 20 times higher-than non-originals (as in the case of first states vs. posthumous states >1, column (4)). This might be due to an extremely poor value of the relative controls, which are the

result of particularly worn-out plates. Remarkably, there are also cases for which differences are not significant. The relative differences in values between prints by Rembrandt and later and posthumous prints could result from the fact that, finally, something of Rembrandt's hand is always present.

Figure 2 illustrates the fitted relative prices within each of the first three regressions, obtained from the exponential transformation of the coefficients of Table II, with posthumous states >1 set equal to 100.[20] Even if the prices of xth states of different regressions are not directly comparable, we can discuss some general patterns. Prints in their first states are much more precious than other original or posthumous prints. Prints in their intermediate states (that is after first states and before last states) tend to reach prices that are about halfway between first states and last states; and, by increasing the total number of states, the relative value of last states tends to approach that of posthumous states, confirming that they are turning points between originality and non-originality.

We also tried to derive conclusions concerning the history of title originality. Prices are not significantly different whether or not original states are followed by late prints and/or posthumous states (this is also true for third states in regression 4). This is confirmed by standard F tests, presented in Table IV. We can infer that, on average, the danger of non-originality associated with replicated titles is somehow compensated by the possibility that only original titles were not interesting enough to deserve copying. The same holds for prints that are in their last state. Different considerations apply, however, for late prints: when they are followed by posthumous states, they may become cheaper than those states, as, for example, in regressions 3 and 4. Could it be that collectors prefer the certainty of buying a posthumous print to the uncertainty of handling a later print?

The multiplication of issues and states is a plausible characteristic of successful titles. These reputation considerations are reflected in the slightly positive impact shown by the number of posthumous states (Table III). The other dummies used to describe non-originality (knowledge of the identity of later printer, posthumous reworker and history of plate collection) always result in negative coefficients, though they are significantly different from zero in only two cases. The coefficient of the number of posthumous states is positive, however, but almost never significantly different from zero.

The dummies employed for the historical definition of rarity prove to work better than the alternative quantitative variable, the sample frequency. In general, only the rarest prints fetch significantly higher prices. The existence of proofs has a positive impact as well. This supports the interpretation of its positive correlation with quality, rather than its negative effect in terms of rarity (working through proofs would have eventually increased the quality of the final product).

Once having controlled for rarity, the evidence that early states are more expensive than the other originals that follow may be explained by the possibility that collectors put a higher value on first states because they are considered more innovative. Even if all further original states are by definition by Rembrandt, we

deduce that collectors associate a lower degree of innovation to them, and therefore a lower value. As stated by Spears (1989: 98), prints are "multiple originals, or multiple copies, [and] represent particularly complex problems." The sequence of original states of Old Master prints can be used to infer something about invention: the first state may be thought of as representing the "starting point,"[21] while subsequent ones are – even if outstanding – variations,[22] additions, corrections, or even artificial differentiations (possibly inspired by market demand) of the first one, on which they are necessarily based.[23]

In what follows we try to combine the results of the four separate regressions in order to compare two first states, two original second states, etc. with different total numbers of original states. In our model the price coefficients of states are deviations with respect to the corresponding price of a posthumous state >1, included in the intercept.[24] According to the results of the four regressions, a first state followed by posthumous states will approximately be priced as follows:

Regression 1: $\exp[(6.7 \pm 1.96 \times 0.2) + (1.2 \pm 1.96 \times 0.1)] = \exp[7.3\text{–}8.5]$
Regression 2: $\exp[(5.8 \pm 1.96 \times 0.3) + (1.7 \pm 1.96 \times 0.2)] = \exp[6.5\text{–}8.5]$
Regression 3: $\exp[(6.7 \pm 1.96 \times 0.5) + (2.1 \pm 1.96 \times 0.3)] = \exp[7.2\text{–}10.4]$
Regression 4: $\exp[(6.2 \pm 1.96 \times 2.1) + (3.0 \pm 1.96 \times 0.5)] = \exp[6.0\text{–}14.4]$

As we can see, the price of a given state is roughly independent of the total number of original states. This outcome is confirmed if we directly compare the price of a given state by running separate regressions for only first states, only second states and only third states, and using other dummies, which combine the total number of original states with the history of the title originality (whether there were only originals, also later prints or posthumous states). As for the previous group of regressions, we have also controlled for other originality aspects, rarity, authenticity, etc. Very few coefficients are significant,[25] leading to the general conclusion that prices of a given state do not significantly vary irrespective of what followed it.

5. Conclusions

The importance of originality as well as the other qualitative attributes of Rembrandt's prints and their appreciation by the international market, have been discussed and analyzed. A definition of originality is provided for prints and price levels of original states by Rembrandt are compared to those of posthumous states.

Controlling for rarity, original states prove to be more expensive than later prints and posthumous states, confirming the main hypothesis of the model. Furthermore, a decreasing value is observed as original state numbers increase. In particular, regressions results point to higher prices for first states as compared to further original ones. Possible interpretations may be found in the collector putting value in a concept close to originality, that is innovation, which decreases as the number

of states increases. On the other hand, a knowledge of what happened to the title of a given print (late prints and/or posthumous states, or further states) does not seem to have an impact on the price of that print.

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Appendix A: Controls Other than Originality and Rarity

A.1. AESTHETIC VALUE

Technique. The following techniques and combinations of techniques have been considered: etching; drypoint; drypoint & engraving; etching & drypoint; etching & engraving; and etching, drypoint & engraving. The control variable is etching. The variety of techniques is considered to be as diverse in prints and printmaking as it is in paintings and drawings (Griffiths, 1981: 135). Rembrandt richly mastered all existing printing techniques with an unforeseen freedom of invention. He used almost uniquely the etching technique, which he mixed and sometimes substituted, starting from the 1630s, with drypoint. In particular, Rembrandt is known for dominating drypoint, as Dürer dominated engraving. The fact that Rembrandt was a real master in printmaking generated an important phenomenon of admiration and imitation, especially for drypoint, at the end of the 17th century and onwards (Griffiths, 1996: 65–76). Therefore, the use of drypoint (alone and/or together with the other techniques) might positively (quality) but also negatively (imitation) affect prices.

Historical period. The creative history of Rembrandt has been subdivided into eight different periods:[26] period 1 (1626–31), period 2 (1632–35), period 3 (1636–39), period 4 (1640–45), period 5 (1646–49), period 6 (1650–53), period 7 (1654–58), and period 8 (1659–65). Historical periods are assigned to titles on the basis of catalogues, despite the fact that some plates were reworked by Rembrandt beyond the creation period (Hinterding et al., 2000). Therefore, here we basically refer to the year of the title's first state. It is reasonable to expect mature (that is more accomplished) periods to be more valued.

Subject. Eight different types of subject are typically distinguished: religious, selfportrait, portrait, landscape, genre, nudes, character, and various subjects.[27] The dummy for religious is set as the control. Schwartz (1998) assumed the existence of a relationship between the number of states and the type of subject for a given title, finding some typical patterns. Therefore, by varying the total number of states, the type of subject might bring different quality, and therefore different price outcomes.

Burr. Burr refers to the presence of a typical technical and virtuosity effect of Rembrandt. Burr is also typical of precious, earlier drypoint issues.

Plate tone. Like the previous variable, this dummy refers to appreciated, special tone effects typical of Rembrandt's ability in inking and printing.

Impression quality. This variable refers to single quality attributes, such as clarity, brightness and delicacy of the impression.

Experts' appraisal. Experts at auction houses can express a variety of generic evaluations that are grouped and ranked as follows: very fine, good, fair. Especially high aesthetic appraisals should positively affect the price.[28] According to Griffiths (1996: 152), "the quality of any impression of a print depends on three factors: the condition of the printing surface at the time of printing, the skill with which it was printed and the care taken to preserve it through the centuries." The control dummy is "not specified."

A.2. AUTHENTICITY

Since, as explained in Section 1, authenticity supports originality, the following dummies defining authenticity should positively affect the price.

Signature. "From the earliest period artists have added their monograms or names to the design on their blocks or plates," and they were used as a kind of "copyright mark" (Griffiths, 1996: 152).

Date. This variable takes on the value of 1 if Rembrandt (presumably) dated the plate. When a print is neither signed nor dated it probably indicates it was not in a final state, thus not yet ready in Rembrandt's eyes. Note however that some masterpieces, such as *The Hundred Guilder Print*, were never signed or dated (Salamon, 1986: 92); fake signatures and dates do exist (Hinterding et al., 2000: 25–26, 202); reworking, resizing or wearing out of the plate could possibly lead to the disappearance of the signature and/or date (Hinterding, 2000: 25–26).

Platemark. Platemark refers to the presence of an indentation around the print margins, produced by the strong impression of the press, typical of in-depth engraving, such as etching, drypoint and engraving (Griffiths, 1996: 34). This variable takes the value of 1 if the plate pressure is visible on the paper.

Special paper. Starting from Rembrandt's time, the type of paper represents an important variable in printmaking. Rembrandt was among the first printmakers to introduce and master experimentation with exotic and special papers (Japan, India and China, made out of mulberry or bamboo, and oatmeal paper and vellum). Very expensive in those times (in Rembrandt's time, exotic papers were imported directly from the Far East) and nowadays still quite impossible to reproduce, these papers were particularly valuable for their glossiness and the special effects they generate together with the inking and burr (Salamon, 1986: 86, 98). This variable is also a sign of quality.

Watermark. In 18th-century Europe workshops producing paper sheets started to apply copper strings in the curing barn. These strings left a void inside the paper, visible in transparency. They had different shapes and symbols (shields, flowers, etc.). Watermarks were typically trademarks for art papers, varying over periods of time, types of paper, regions and royal concessions (Salamon, 1986: 87–89). Only recent technological improvements have allowed the beginnings of systematic study and listing of original watermarks in papers used by Rembrandt (Hinterding, 2000). Due to financial reasons the presence of watermarks is less frequent in smaller prints than in larger complete sheets.[29]

Additions. Sometimes pigments (pen, ink, pencil, chalk, etc.) were added to the print. Some additions were used by Rembrandt "in order to try out the state changes" (intermediate issues), but some of them were signed and dated as well (Hinterding, 2000: 26–27). Printing ink was added to simulate burr (Biörklund and Barnard, 1968: 10).

A.3. CONSERVATION STATUS

Conservation status derives from production and conservation habits. It is captured by several sets of dummies, described below.

Size of margins. As explained by Griffiths (1996: 145), margins are "any area outside the plate-mark of an intaglio print or outside the drawn border of other classes of prints in the margins. Owners before the 18th century almost invariably trimmed margins off their prints in the process of pasting them into albums. A print trimmed just outside the plate-mark is often described as having thread margins. In the 19th century collectors began to place a quite irrational premium on margins." This variable is represented with a set of dummies ranging from full margins, through large margins, margins, small margins, borderline, to "into image." Larger margins should be more valued than smaller ones, even if too large margins should raise authenticity problems due to production patterns (cost of the paper sheets), past collecting habits, and the passing of time (Salamon, 1986: 107).

Other conservation characteristics. A series of single dummies describing other aspects of the state of conservation are included, such as: dummies controlling for conservation of margins (good margins, tried margins, tears to margins, repaired margins), and others, such as: glued print, paper defects, losses, repaired print, tears, skinning, creases, fold, foxing, staining, discoloration and general defects. Prints sapped by one or more defects should be cheaper.

A.4. OTHER CONTROLS

Surface. Expressed in square centimeters, this variable usually refers to the paper sheet, thus including the plate size[30] and possible margins. As shown in previous studies on art markets, larger works might be sold for higher prices.

Auction house. The database include transactions passed through auction houses in Europe and North America: Bassenge, Berlin (D); Bonhams, London (UK); Butterfield, San Francisco (US); Christie's, New York (US); Christie's, London (UK); Doyle, New York (US); Drouot, Paris (F); F. Dorling, Hamburg (D); Hauswedell, Hamburg (D); Karl & Faber, Munich (D); Koller, Zurich (CH); Kornfeld, Bern (CH); Phillips, London (UK); Sotheby's, London (UK); Sotheby's, New York and Chicago (US); Swann, New York (US); Winterberg, Heidelberg (D); Germany, others; France, others; North America, others, Europe, others. The control is Christie's, London. Since Christie's and Sotheby's dominate the market in terms of the number of transactions, they are expected to record higher prices than more local competitors.

Year of transaction. Each year from 1985 to 1998 is represented by a dummy variable. The control is 1985. These variables control for possible fluctuations in the market for Rembrandt's prints.

Month of transaction. Each month is represented by a dummy variable. May is set as the control. This group of dummies captures possible seasonal effects.

Appendix B: Quality Impact Other than Originality and Rarity

From the four regressions presented in Sections 3 and 4, we also obtained a whole set of results for other controls besides originality and rarity, that is aesthetic value, authenticity, conservation status, and others.[31] Here we summarize the main results.

When varying the total number of states, we see some pricing heterogeneity especially for techniques, and, to a lesser extent, for other typical characteristics of aesthetic value, such as historical periods and subjects. This confirms that the number of states is also an expression of Rembrandt's creativity. Schwartz (1998), for example, tried to infer the relationship between the number of states and

subjects, finding some typical patterns. This would explain some contradictory results in the different regressions, and higher standard errors in the fourth regression (more than 3 states) as compared to the previous ones.

Some combinations of techniques (drypoint & engraving, etching & drypoint, and etching, engraving & drypoint) seem to fetch higher prices than etching alone. Remarkably, drypoint alone seems to be the cheapest, especially in unique states. Historical periods show more homogeneity in prices than techniques. Period 7 (1654–58), a period of maturity, is the one that is the most valued. It is followed by the previous period 6 (1650–53) and period 3 (1636–39). Concerning subjects, self-portraits and landscapes – for which Rembrandt the printmaker is especially appreciated – are the most expensive ones. This is also consistent with the fact that religious masterpieces are practically out of the market. Experts' judgment considerably affects prices, but only for outstanding (i.e., "very fine") appraisals. Surprisingly, burr is not significant, but this is consistent with most of the results for its technique, drypoint. On the other hand, platetone (a typical skill of Rembrandt in printmaking) is significantly valued whatever the total number of states.

Authenticity positively affects prices, especially through its most objective characteristics of watermark and special paper, as expected. The first result would support current efforts at closer investigations of watermarks, also with the support of high technology.[32] The second result reinforces the quality effects, since Rembrandt made special impressions on special papers for his friends and best collectors (Salamon, 1991: 14, 25). Overall, both results confirm that paper and watermarks analysis are important elements for dating and authenticating prints with sufficient accuracy (Salamon, 1986: 89).

We can also generally conclude that the existence of margins is positively (even if not always significantly) valued. The opposite is true when there are no margins. Bad conservation conditions as a whole might constitute a penalty for market value, even if coefficients are rarely significant, which is also due to the limited number of observations. As expected, surface has a significantly positive effect on prices.

Only Sotheby's London and Sotheby's U.S. sometimes manage to obtain higher prices than Christie's London. But records were attained by Kornfeld, a Swiss auction house specializing in Old Master prints. Finally, it is not possible to infer a general trend for prices. Higher prices were reached towards the end of the 1980s, at the time of the boom in all art markets. Starting in the mid-1990s, prices went back to the 1985 levels.

Notes

1. Copies as such have played and continue to play an important and positive role in relation to originals. Lazzaro et al. (2004) provide an analytical framework for copies based on market differentiation, informational asymmetry and adverse selection. According to these criteria, a copy can become a fake depending on the intention to deceive of the seller and/or the missing information of the buyer, besides the general presence of "radical uncertainty" on both sides. Apart from sellers' and buyers' intentions, copies are defined in a functional way. They can be the product of learning, thus resulting in "interpretation," "mediation" or "adaptation" processes. In this case the similarity to the original will be less perfect (Benhamou and Ginsburgh, 2002: 5, 15). Copies also represent a reserve of the originals, which may be lost, or simply to avoid their over-consumption due to environmental factors (light, heat, etc.), or accidents. Finally, copies play an educational function, providing those museums not having the means to own or exhibit an original, to display at least a copy.
2. Griffiths (1996: 153) provides a definition of state, and describes the problems arising from its analysis. He defines a state as "any impression which shows additional working on the plate," and specifies that "only intentional changes to a plate count – not accidental scratches." Salamon (1986: 89–91) defines a state as the "variation in the print composition, as a consequence of

any modification made to the plate." Technically speaking, the plurality of states is typical of copper plates, rather than wood and modern techniques (therefore in use only after Rembrandt's death), such as lithography, invented in the 18th century, or steel facing, which appeared in the 19th century (in particular, steel facing applied with electrolytic technique aims to considerably increase the number of issues without the need of any further change to the plate). States are usually expressed in Roman numbers, such as I/II, III/V, and so on, where the first number is the actual state of the copy, and the second one is the total number of existing states. When the second number is not specified, the actual state coincides with the number of total states (e.g., "I" means unique state, "IV" means last state of four, etc.). The state number must not be confused with the edition number (usually marked with, e.g., 1/30, 4/50, etc.), where the numerator is associated with the printed issue, and the denominator with the total number of printed issues. In this study we will not consider this artificial aspect of rarity, since the practice of numbering editions appeared only after 1880 (Griffiths, 1996: 147). Before then, additional copies were simply produced on request (Salamon, 1986: 95) – see Section 3.2 for rarity.

3. According to Griffiths (1996: 46), "the entire history of Western art would have been quite different if printmakers would have not rapidly disseminated every stylistic innovation through Europe." At the beginning, prints were not made for pure creative purposes. Before the first xylographies and after 1430, the first prints were produced from precious plates engraved by goldsmiths. It was not until after the 15th century that prints became more important than their plates. With Dürer (1471–1528), they became a major art (Griffiths, 1981: 138–142; 1996: 9–10). The development of the technique and the art of printmaking, and the production and circulation of prints experienced a first upswing in Italy and in Northern Europe in the first decades of the 16th century. Its potentialities as a promotion medium were already commonly clear. For example, it was thanks to prints that Dürer truly succeeded in Italy, and that Raphael resorted to using them in face of the competition of Michel-Angelo (Griffiths, 1981: 144–148). Raphael made the drawings, then he supervised and was assisted by an expert, the printmaker Raimondi with his staff, and the publisher Baviera (Griffiths, 1996: 46–63). Unlike paintings, prints maintained very low prices until the beginning of the 19th century, when they started to rapidly increase, followed by books and drawings (Salamon, 1986: 135–139). Nowadays, dedicated auctions of Old Master prints are relatively rare, since the stock is becoming smaller and smaller (Salamon, 1986: 143).
4. For a portrait of Rembrandt as an entrepreneur, see, among others, Alpers (1990) and Van de Boogert (1999).
5. The most complete public collections of Rembrandt's prints are located at the Department of Prints of the British Museum, London (the complete collection in all states); the Prentenkabinet of the Rijksmuseum, Amsterdam; the Print Cabinet of the Hermitage, St. Petersburg. In general, most renowned European and U.S. museums and galleries host prints by Rembrandt in great amount and quality.
6. This is the first state of the *Arnold Tholinx* (B. 284) (Salamon, 1986: 113).
7. Their account for the qualitative determinants of prices has been a reference for several further studies. For example, for modern paintings Lazzaro and Mossetto (1997) have also used, as a proxy variable for quality, quotations in specialized literature, obtaining significant results.
8. See References.
9. Commissions usually vary across countries and are approximately the following: Switzerland and Germany, 15%; France, 21%, 16.5% for amounts above 2 million FFR; in Anglo-Saxon countries the buyer's premium varies between 10 and 19.5% (according to the hammer price). Vendor's commissions range from 12% to 22%.
10. If, for example, the total number of states of a print is 3, and the print is state 2, we face an original state. If, instead, the state is 4, it is non original (posthumous).

11. In this definition of posthumous state there is no control at all for the total number of original states, which varies quite a lot. This problem is partially solved with the ratio.
12. As we have seen in Section 2, an alternative and continuous variable is expressed by the ratio $r =$ (original or posthumous state/number of original states), with $r > 0$, or its transformations.
13. Because of the "low commercial potential" of drypoint, it seems that Dürer, unlike Rembrandt, quickly abandoned this technique, considered a "loss of time in terms of profitability" (Griffiths, 1996: 71–76).
14. This also explains why there is need to go back to the plate and refresh it in order to increase production.
15. For remarkable prints still on the market, Salamon (1986: 108) adds that in general it would be possible to estimate the number of existing issues, based on the number of known issues, the history of collections and of important historical sales, and what already belongs to public collections (supposed not to change). But the existence of unknown collections, the destruction of some prints and, finally, the history and exploitation of Rembrandt's plates, make the enterprise very difficult.
16. Mainly Hinterding et al. (2000), Salamon (1991) and Nowell-Ustike (1967).
17. Standard F tests confirmed that the solution of four separate regressions is preferred to using the full set of observations in a pooled regression.
18. This would especially be the case when the original number of states was not established in advance in Rembrandt's work conception, which was sometimes the case. See Schwartz (1998) for an analysis of the total number of states and their implications.
19. "possibly."
20. Since prices are log-transformed, the effects of dummy variables in terms of percentage on prices, are given by $e^b - 1$, where b is the regression coefficient (Halvorsen and Palmquist, 1980).
21. Turner (1996), Vol. 7, p. 830.
22. For a definition of copy and variation in Rembrandt's time, see, in particular, Laclotte and Cuzin (1979), Vol. 2, p. 374.
23. First states can be already accomplished states or be preceded by trial states or proofs. In the case of "prints that were already complete in the first state, it is unclear whether Rembrandt himself was responsible for tiny changes" in subsequent states (White and Boom, 1969, Vol. 1, p. 86). See also Haggar (1962: 272).
24. Note that other controls are also included in the intercept terms. In the approximation that follows we neglect the possibility that these controls are not always the same in all four regressions.
25. Main results of this further model specification are available from the author on request.
26. Cf. Boon (1963) and the other catalogues in the References. A synthesis is available from the author on request.
27. "Character" refers to the study of a person's particular attributes or traits, and "genre" to the description of more complete scenes and figures. According to Luijten (2000: 17, 21), "with portraits, the plate usually became the sitter's property, and in consequence impressions of certain portraits are extremely rare," therefore more expensive. On the other hand, he also adds that "unlike most of the master's other prints he had no control over their marketing." This, and the fact that those plates "often turn up in the inventories" of the descendants' possessions could have generated additional impressions and states not by the hand of the master. Anyhow, the fact that, for Rembrandt, portraits represented a "lucrative business," especially in his difficult financial times, is not a sufficient condition for suspecting lower aesthetic quality, and thus lower prices, also because his collectors were quite demanding.
28. Despite the fact that these experts are paid by auction houses, their judgements are expected to be quite consistent, since the market for Old Master prints is a market of connoisseurs.

29. Given the high cost of paper, the artist tended to use every single square centimeter of it. Several prints, especially if of reduced dimensions, could be made out of a single sheet, marked by just one watermark (Salamon, 1986: 87–89).
30. For a given title, the size of the plate generally remains constant, but successive states can present a variation in sheet dimensions (usually a reduction).
31. Results are available from the author on request.
32. See Hinterding (2000). Nevertheless, because of the size of the sheets used, not all original prints have watermarks. Hinterding (2000: 26) estimates that about 1 to 3 original prints have watermarks or a fragment of them. Special papers, like vellum, Asian and oatmeal papers have no watermarks at all.

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