

The Determinants of Art Prices: Analysis of Joan Miró

Abstract

We study the determinants of art prices of Joan Miró analyzing 255 of his artworks sold at Sotheby's and Christie's between 2003 and 2017, and performing a hedonic price regression. Miró's works command higher prices, *ceteris paribus*, when: they were painted on canvas, were sold at Sotheby's and in New York City or London, were traded in the evening session, the larger their area, if they had appeared in an art book, the greater the number of words used to describe the respective lot, and depending on the period in which they had been painted. The prices of Miró's paintings increased substantially between 2003 and 2008, and then declined, coinciding with the global financial crisis of 2009. This is the first exhaustive study carried out on the determinants of the prices of Joan Miró's works. So far, only studies of Pablo Picasso and Andy Warhol have been of conducted. Joan Miró has well-defined artistic periods, which also allows us determining the impact on the price of the works carried out in each period.

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Most economists agree that the prices of artworks reflect, on average, their value and quality (Coslor and Spaenjers, 2016). However, this proposition is still controversial among the general public and art historians (Edwards, 2004).

In recent decades, the international art market has attracted increasing interest from collectors and investors, both individual and institutional. On the other hand, there is an extensive literature on the determinants of art prices, either by style or artistic movement, or for the aggregate art market (see, for example, the works of Baumol, 1986; Goetzmann, 1993; Mei and Moses, 2002; Higgs and Worthington, 2005; Campbell, 2008; Renneboog and Spaenjers, 2013; and Garay, 2017; among others). However, we know relatively little about the determinants of the art prices for specific artists, except for the work of Biey and Zanola (2005), who studied the factors that affected the prices of Picasso's serigraphs, and for the recent studies by Stepanova (2015), dedicated to analyze the prices of Picasso's oil paintings, and Pownall and Graddy (2016), who studied the price determinants of Andy Warhol's serigraphs.

The main purpose of this paper is to establish the microeconomic variables that impact on the price of the works of a specific artist, in this case Joan Miró, one of the great masters of surrealism. This work represents, as far as we have been able to verify, the first one carried out to establish the investment attributes of Joan Miró's artworks.

It is important to note that there is a sufficiently high number of works by this artist that have been traded at auction, which is a necessary condition to carry out this type of work. More specifically, this paper analyzes artworks executed by Joan Miró and auctioned at Christie's and Sotheby's, the two main auction houses in the world, between 2003 and 2017. We estimated a hedonic regression model, in which the dependent variable is the price of each work sold (expressed in natural logarithm) and the independent variables are: area of the painting, if it is signed and dated, name of the auction house, auction city, auction date, auction time, lot number, style of painting, number of words in the catalog, whether the artwork has been published in an art book or catalog, and the number of exhibitions in which the work has taken part, among other variables.

We also estimated the historical performance of having invested in Joan Miró's artworks. The results of this paper are of great interest both from the academic point of view, and from the perspective of those who take part in the art market (galleries, art fairs, dealers and investors in art).

The following section presents a review of the literature on the attributes of art as an investment. Afterwards, we explain the data and the methodology followed in the work and analyze the results obtained. Finally, we present the conclusions, implications and possible extensions of our work.

1. LITERATURE REVIEW

This section offers a brief introduction to Joan Miró and a summary of the literature on the attributes of art as an investment.

1.1. Brief introduction to Joan Miró

Surrealism is an artistic movement that began in France in the 1920s from Dadaism. Surrealists expressed their art from the images of their dreams, having Sigmund Freud, the father of psychoanalysis, as the main character, associating very dissimilar elements and letting thoughts flow freely. Surrealism gives rise to artworks that do not have any kind of restriction and that are often illogical and grotesque.

In Spain, surrealism also appeared around the 1920s mixed with elements of popular painting and symbolism. In addition to Joan Miró and Salvador Dalí, Spanish surrealism is composed of other artists, such as: Gregorio Prieto, José Moreno Villa, Benjamín Palencia, Maruja Mallo and José Caballero (Boix, 2010).

Joan Miró i Ferrà was born in Barcelona on April 20th, 1893, into a family with artisan's traditions, representative of the Catalan middle class that had emerged since 1875 from the Second Industrial Revolution and turned into rentier owners, although without losing its peasant roots (Boix, 2010). Besides being a painter, Miró was a ceramist, sculptor and engraver. His work reflects his interest in the "infantile", in his autonomous community and in the subconscious. In numerous interviews and writings of the 1930s, Miró expressed his desire to abandon the conventional methods of painting in order to formulate a form of expression that was contemporary and surreal. The French poet André Breton considered Miró to be the most surrealist of all artists. Several authors have studied the artistic periods of Miró. Thus, for example, Dupin (1993) and Bourlier (2013) focus their studies on cataloging the works of Miró according to his artistic period. Boix (2010) classifies the artistic periods or stages of Miró as follows:

1. The formation (1893-1915): During this period, the ideological formation of Miró is constituted by a conflicting mixture of ideas: between Secularism and Catholicism, between Catalanism and Spanishism, between the Republic and the Monarchy, between progressivism and conservatism.
2. The artist: 1915-1919: After a phase of modernity in which fauvist works prevails (from 1915 to 1917), in 1917 Miró is oriented towards the European avant-gardes.
3. The period 1920-1939: This period begins with Miró's first trip to Paris and is divided in two stages: 1920-1929 (in which Miró embraced surrealism), and 1930-1939 (stage in which Miró moved towards a "wild" expressionist style). During this two-decade period, Miró was married and lived through the crisis of the 1930s that ended in the civil war (1936-1939), which was of transcendental importance to Miró. For this 20-year

period, the styles to be used in this study were determined according to what was proposed in the work of Bourlier (2013): From 1920 to 1927: "Catalan Fauvism, Mutation and Oneiric"; from 1929 to 1935: "Anti-Painting and Organic"; and from 1936 to 1939: "Monsters".

4. The period 1940-1967: It begins with Miró's return to Spain and is divided in two stages: 1940-1956 (which could be defined as internal exile and return to the world), and 1956-1967 (Majorcan stage in which a new language change occurs).
5. The period 1968-1983: This period is divided in two stages: 1968-1975 (in which Miró manifested itself in various forms against the Franco's regime), and 1976-1983 (democratic transition following the death of Franco and the subsequent attainment of freedom). Miró died on December 25th, 1983, in Palma de Mallorca.

It is important to note that Joan Miró represents an ideal case to study the determinants of artworks prices of a specific artist. This is due to the large number of works that Miró executed during his long and prolific life and that have been traded in the main auction houses of the world, the great variety of formats he used and the diversity of styles he presented throughout his life, reflected in the periods described above.

1.2. Summary of the literature about the attributes of art as an investment

The poor performance shown by bonds and stocks worldwide since the beginning of the 21st century, including the collapse of financial markets during the 2008-2009 Global Financial Crisis, encouraged investors to explore other investment alternatives, such as those represented by: investments in hedge funds, commodities, private equities, works of art, among others. Art investments have generated an increasing interest on investors (see, for example, Goetzmann, 1993; Campbell, 2008; Mei and Moses, 2002; Renneboog and Spaenjers, 2013; and Garay, 2018). The study of art as an investment alternative has also benefited from the growing availability of data and prices of artworks auctioned around the world.

Unlike bonds, stocks and real estate, for example, works of art are a very special investment asset since, in general, they do not provide income to their owners. In addition, works of art allow collectors to enjoy "aesthetic" benefits, apart from the eventual financial benefits. This leads to consider artworks as consumer goods (Baumol, 1986); other authors characterize them as "emotional" or "passion" assets.

Academic research about the attributes of art as an investment received a boost in the 1980s with the study of Baumol (1986). Previously, in the 1960s, in harmony with the boom experienced by the art market since the previous decade, the first price indexes for artworks were designed (see the review presented by Coslor and Spaenjers, 2016).

The two most common methods that have been used to measure the return on art investments are the repeat sales regressions and the hedonic pricing model. The repeat sales regression method considers, for the

same work of art, the prices at which a lot has been sold on two or more occasions at auction during a certain period of time (hence the name of repeat sales). Being the same work of art that is being sold, its characteristics remain constant over time. Thus, the main advantage of this method is that uses a standard point of comparison for all works to be studied. However, the main disadvantage is that because of using only the sale prices of the same work, it only considers a small fraction of all the works that have been auctioned over a certain period of time. Another disadvantage is that the repeat sales method suffers from a selection bias that tends to cause the returns of investing in art, when measured using this method, to be greater than those actually recorded. The reason for this is that a work of art that is presumed to have increased in price is more likely to appear again for sale at auction, compared to the case of an artwork whose price is presumed to have decreased since it was bought (see Goetzmann, 1993).

Finally, another disadvantage of the repeat sales method is that it is often not possible to determine with complete certainty that a pair or a triplet of sales made over time corresponds to the same work.

The hedonic pricing model allows the construction of an art price index when performing an econometric regression in which the dependent variable is the price of each artwork and the independent variables are each one of its attributes or characteristics, such as: if the work is signed or dated, area of the painting, technique used, auction year of the work, etc., obtaining an estimated value of each attribute. In addition, from the coefficients of the variable "auction year" it is possible to estimate a price index for the artworks.

The main advantage of this method is that it allows the researcher to use all available information about the transactions contained in a database. Its main disadvantage is that with this method the selection of the variables to be used is more complicated, so that the regression does not present problems and robust results are obtained. According to Rosen (1974), creator of the hedonic pricing model, a series of classes of a heterogeneous good can be represented by a set of attributes. In addition, there is no specific market for each attribute and, therefore, its price is not directly observable (Bilbao, González and Rodríguez, 2015).

It is important to mention that the methodology of hedonic pricing can also be applied to the valuation of alternative investments in public and private goods different from the art market, for example: the real estate market. Thus, Bilbao, González and Rodríguez (2015) study the valuation made by the touristic market in the construction of a public infrastructure in the city of Gijón, Spain, based on the hedonic pricing method.

As we discussed above, Baumol (1986) conducted one of the pioneering studies in which he estimated the return on art investment. The study was made from the data contained in the book by Reitlinger (1961) and using the methodology of repeat sales, finding that art offered a real return of only 0.6% per year between 1652 and 1961. Goetzmann (1993) extended the study of Baumol (1986) until 1986 and established, also using the

method of repeat sales, that the return on art investment exceeded 2% per year at the rate of inflation recorded between 1716 and 1986, being this performance similar to that of bonds and less than that of stocks.

Mei and Moses (2002) used a database of 4,896 repeat sales to create an annual index of art prices between 1875 and 2000, finding that the performance of art had been above that of fixed income assets, but below the corresponding returns for stocks. Campbell (2008) used semiannual data from "Art Market Research and Mei Moses" from 1976 to 2002, which are constructed using a twelve-month moving average and applying the repeat sales model, and obtained results similar to those of Mei and Moses (2002), concluding that the inclusion of artworks in an investment portfolio helps to reduce its risk. This is because the correlation between the artworks returns and those of stocks and bonds is low, and that is why art is presented as an effective asset when diversifying the portfolio. In addition, Campbell found that art returns are above the inflation rate and that of government bonds, but below that of stocks.

Korteweg, Kräussl and Verwijmeren (2015) analyzed 32,928 works that were sold repeatedly in the period 1960-2013, and found that the apparent performance offered by artworks was reduced from 8.7% per annum to 6.3% per annum because of the selection bias of the repeat sales method, according to which the works that are presumed must have gone up in price are more likely to be offered at auction compared to those for which the seller conjectures that their prices may have declined since the painting was bought.

Goetzmann, Renneboog and Spaenjers (2011) studied how the income of the highest income earners and returns of stocks and bonds influence art prices, finding that the latter increase when the distribution of income becomes more unequal and responds with an annual lag to stock prices. The authors used the data collected in the book by Gerard Reitlinger (1961) and updated it, to later apply the repeat sales regression and to elaborate an annual index in real sterling pounds from 1830 to 2007.

Higgs and Worthington (2005) investigated the determinants of art prices in the Australian art market by creating a price index for the period 1973-2003 using the hedonic pricing method, and considering a total of 37,605 artworks from sixty recognized Australian artists, sold in the main auction houses of Australia and the world. The variables (attributes) considered by Higgs and Worthington in the hedonic price regression include: the name of the artist, if the artist was alive or had already died at the time of the auction, the auction house, the technique used, if the work was signed, its dimensions and the year it was sold. The authors found that the annual nominal return of Australian art was 6.96% (in Australian dollars) with a standard deviation of 16.51%. The regression suggests that variables such as the names of the artists, or the fact that they had died before the auction was held, increased the value of the works, as well as those Works that were executed in oil or using acrylic. Likewise, it was found that the artworks sold at Sotheby's or Christie's commanded higher prices.

Renneboog and Spaenjers (2013) also used the hedonic pricing method and analyzed a database of more than one million sales of paintings carried out in auction houses around the world between 1957 and 2007. The authors found that the prices of the works were determined by: their size, the technique used, if they were signed or dated, the topic of the work, and the place where they were auctioned, among others. This is the largest study that has been done to date, since it considers more than one million transactions and more than ten thousand artists. The authors found that art offered an annual real return in dollars of 3.97%, which was similar to that of bonds, but with a much higher risk. In addition, they determined that the correlation between the returns on art and financial assets is quite low or even negative. Also, the correlation of art with gold, commodities and real estate is low.

The following are other specific conclusions of this work: The signed and dated works were sold at prices that were approximately 31% and 19% higher, respectively, than those works that were not; prices increase with the size of the work to a certain point where it becomes too large and the price begins to fall; works of art increase in value by 13.5% after the artist is incorporated into an important reference book of art history; the style and technique used affect the price of the work, being oil the most expensive; the auction months have an influence on the price of works, being May and November the months with the highest prices (the most important auctions of Christie's and Sotheby's are usually carried out during these months); higher prices are paid when artworks are sold at auction houses Christie's and Sotheby's; and the authors found that Pop Art has performed better than other movements such as Cubism or Rococo in recent years.

Finally, in a more recent work, Stepanova (2015) determined that works of art that had a greater color intensity tend to have higher prices. For this, she used data from the paintings executed by Pablo Picasso and sold at Christie's and Sotheby's auction houses between 1998 and 2014. Stepanova found that there was a strong correlation between the price of Picasso's paintings and the surface occupied by the blue and orange colors. While the orange colors gave the work an increase in price of 50% compared to other tones, the blue colors gave an increase of 21%.

In that study, Stepanova also determined that the works sold in the evening auction session (when the most expected auctions by collectors and investors take place) tend to be more expensive than those sold during morning auctions. Stepanova (2015) also found that Picasso's works commanded higher prices, *ceteris paribus*, when the area was increased and if they had appeared in art books. Likewise, of the eight artistic periods of Picasso, only the works belonging to the Blue and Pink period (1902-1906) were statistically more expensive than those belonging to the period that was excluded in the regression of the study (Childhood and Youth, 1881-1901). In addition, the following variables were not significant: if the work was signed, if it was dated, if it was

painted on canvas (compared to wooden support), if the work was auctioned at Sotheby's compared to Christie's, or that it had been previously exhibited in museums or galleries.

The following were other studies that applied the hedonic pricing method to measure art investment returns: Buelens and Ginsburgh (1993), Agnello and Pierce (1996), Taylor and Coleman (2011), Garay, Vielma and Villalobos (2017) and Garay (2017). Tables 1 (repeat sales) and 2 (hedonic pricing), which have been adapted from Garay (2018), show the results reported in the literature regarding the risk and return of having invested in artworks. The following general conclusions can be drawn:

- 1) Most of the studies carried out analyze the art performance by studying price indices for countries or artistic movements. There are few studies dedicated to analyzing the investment attributes of the works of artists considered individually (only the study by Pesando and Shum, 1996, for Picasso's prints; the recent studies by Stepanova, 2015, for Picasso's paintings; and Pownall and Graddy, 2016, for Andy Warhol's serigraphs).
- 2) The real rate of art return has been positive in almost all cases, and relatively moderate. Those cases in which art returns were reported in nominal terms, it was evidenced that these were also positive in real terms, although in many cases they were only slightly positive.
- 3) In almost all the studies, the recorded return of art investments has been lower than that of stocks and, frequently, similar to that of government bonds, although with a higher level of risk than that of bonds and similar to that of stocks.

Table 3, also adapted from Garay (2018), shows the risk and return of art investments by styles/movements that have been reported in the literature. All the studies by art styles/movements that were found are based on the hedonic pricing model because the repeat sales method only allows us to consider a small sample of the universe of works traded at auction.

2. DATA AND METHODOLOGY

There are different channels through which it is possible to acquire works of art, such as auction houses, galleries and dealers. For this study, we use the information referred to the sales of works at auctions, since these constitute the only public and systematic sources of artwork prices. Likewise, we use data from works of Joan Miró sold at auction for the period 2003-2017 and whose source of information comes from the websites of Christie's and Sotheby's auction houses, which are the two most prestigious auction houses worldwide. All available data was collected on the respective auction houses websites (www.sothebys.com and www.christies.com), complementing the information with the Blouin Art Sales database, achieving a total of 255 paintings executed in oil, oil and mixtures, and other techniques. We decided to concentrate the study on works

executed in these three categories to have a sample as homogeneous as possible in terms of the technique used, taking also into consideration the relatively high number of works executed in oil and in oil and mixtures and auctioned in the study period. Sculptures were excluded (for a study of the price determinants of sculptures see Vosilov, 2015), as well as lithographs and works made using multiple techniques. The hedonic regression model was estimated using the Ordinary Least Squares Method. As previously mentioned, the hedonic pricing method assumes that the price of an artwork is equal to the sum of the prices of its characteristics or attributes. Among these attributes are, for example, the size of the work, if the work is signed and dated, etc. (there is a list of attributes to consider below in this section). The combination of the whole sales made allows to obtain the implicit (or hedonic) prices of the artworks. The regression by means of which the model was estimated is as follows:

$$\ln P_{kt} = \alpha + \sum_{m=1}^M \beta_m x X_{mkt} + \sum_{t=1}^T Y_t x D_{kt} + \varepsilon_{kt} \quad (1)$$

Where:

$\ln P_{kt}$: Price, in natural logarithm, of painting k auctioned at year t (including the “buyer's premium” or commission). It is the dependent variable of the model and it is expressed in nominal dollars.

X_{mkt} : Value of the attribute m of artwork k auctioned at year t .

D_{kt} : Dummy variable that takes the value of 1 if artwork k is sold in year t and 0 otherwise

β_m : Price of attribute m .

Y_t : Coefficient with respect to the year-dummy variable (these coefficients are used to estimate the value of the hedonic price index in each year t).

The list of the attributes considered in the regression model is presented below:

- Technique used: works of art are classified as having been executed in any of the following techniques (dummy variables): Oil only, oil and others, and other techniques.
- Support: if the works were painted on canvas or using another support.
- Auction house: it distinguishes if the work was auctioned at Christie's or Sotheby's.
- Auction city: it considers if Miró's artworks were auctioned in New York, London, Paris or Madrid.
- Auction time: it allows studying the impact on the price of works sold in the main auction events, mostly at night, or in the secondary ones, mostly during the day.
- Dated: it distinguishes if the work is dated or not.
- Signed: it distinguishes if the work is signed or not.
- Area: it considers the artworks' measurements in inches (height by width).

- Area squared: it is used to evaluate whether the prices of artworks increase at a decreasing rate as the size increases.
- Auction lot number: included to analyze if the order in which the lot was auctioned during the session affected its price.
- Auction lot number squared: it is used to evaluate whether the prices of artworks increase at a decreasing rate as the auction lot number increases.
- References in literature: number of times the work had been mentioned in art books or art catalogs.
- Exhibitions: number of times the work had been exhibited in galleries, art halls and museums.
- Provenance: number of owners the artwork had had until the time of the auction.
- Number of words used to describe the lot in the catalog: the greater the number of words, the greater the importance of the work, at least in the opinion of the auction house.
- *Catalogue raisonné*: whether the work appears in the *catalogue raisonné* or inventory of all the artist's works.
- Certificate of authenticity: if the work has been certified by an expert.
- Artistic period: it is evaluated the date on which the work was executed to assign it the period of Miró to which it belongs. As mentioned above, the artistic periods of Miró are the following (until 1939 they were based on Bourlier, 2013, and subsequently they were based on Boix, 2010): 1) Until 1919: Beginnings; 2) 1920 to 1927: Catalan Fauvism, Mutation and Oneiric; 3) 1929 to 1935: Anti-Painting and Organic; 4) 1936 to 1939: Monsters; 5) 1940 to 1967: Internal Exile and Majorcan Stage; 6) 1968 to 1975: Against the Francoism; and 7) 1975 to 1983: Transition to Democracy.
- Year of the auction: it is considered the year in which the auction was carried out. The value of the coefficient obtained from the regression is used to elaborate the price index of Joan Miró, similar to what was done by Higgs and Worthington (2005), Renneboog and Spaenjers (2013) and Garay (2017).

3. ANALYSIS OF RESULTS

Table 4 shows the descriptive statistics of this study. The average sale price (including the buyer's premium) of the 255 Miró's paintings that constitute our sample was \$2,414,736, with a relatively high standard deviation of \$4,445,636. The majority of the works were signed and dated by Miró (95% and 97%, respectively). The table also shows that 163 of them were painted in oil, 81 in oil and mixtures, and only 11 with other techniques. Of the 255 works, 148 were painted on canvas, while the average area of the works was 933.46

square inches (with a high standard deviation of 1,123.77 square inches, due to the fact that Miró executed his artworks with a great variety of formats throughout his life).

On average, the works in the sample had had 3.38 owners (provenance), had been exhibited in 1.86 exhibitions (galleries or museums), had been mentioned 2.13 times in books or art catalogs, and had on average 514.52 words in the catalog note that described the work in the respective auction. The table also shows that the most expensive works are those belonging to the period "Catalan Fauvism, Mutation and Oneiric" (1920-27), followed by those belonging to the period "Anti-Painting and Organic" (1929-35).

Table 5 shows the regression results. In the first place, the R-squared of the regression was quite satisfactory (0.84), which indicates that the price of Miró's works is explained in 84% by the variables or attributes selected. The coefficients of variables "signed" and "dated" were not significant. These results, apparently contradictory, are nonetheless consistent with those found by Stepanova (2015) for Picasso, and Campos and Barbosa (2009) for Latin American art. Possibly, the fact that the great majority of works have been signed and dated by Miró (95% and 97%, respectively), does not allow to discriminate the effect of these variables on the price of the paintings. In addition, the fact that the works are signed and dated adds, in principle, an element of authenticity to the works. However, being very high quality artworks (since they have been sold at Sotheby's and Christie's, the two most prestigious auction houses in the world), this element of authenticity may not be as important, something that could be more relevant for works that have lower prices and that are sold at other auction houses.

Artwork prices increase 0.04% for each additional square inch of area and this rate is decreasing (reflected in the negative and significant coefficient of the variable Area squared). This result is consistent with that found in the existing literature (see, for example, Renneboog and Spaenjers, 2013; and Garay, 2017). Regarding the technique used, no significant results were obtained. This is not surprising, since 96% of the works analyzed in this work were executed in oil or oil and other techniques. We found evidence (Higgs and Worthington, 2005; Renneboog and Spaenjers, 2013; Garay, 2017) that works painted in oil tend to be worth more, *ceteris paribus*, than those executed using watercolor, pastel, ink, pencil, among others. Oil is a more expensive technique, more durable and more difficult to master by the artist (compared to other techniques), and hence the greater value the market tends to assign to works executed using this technique.

The artworks painted on canvas are worth 42.10% more than the works painted on other supports. This result is very interesting, and our study is the first to document, as far as we have seen, the importance of the support of a work on its price (for example, and as commented above, Czujack, 1997, and Stepanova, 2015, did not find significant price differences between works painted on canvas or on wooden support in the case of Picasso). Presumably, a work painted on canvas can better withstand the passage of time than a work painted on

paper, even if that paper is placed on top of a canvas. The works auctioned in the evening sale of both auction houses are worth 104.20% more than those sold in the morning or afternoon session. The evening sale is considered the auction star of both auction houses, so this finding is not a surprise. This result is consistent with the one reported by Stepanova (2015) in his study of the price determinants of Pablo Picasso's works. In our case, Miró's works sold at Sotheby's are worth 42.46% more than those sold at Christie's. This result is striking since, in general, it has been found in the literature that the prices of the works of different artists sold in both auction houses tend to be very similar, *ceteris-paribus*.

The Miró's works of art sold in New York and London are more expensive than those sold in Paris or Madrid. This finding suggests that the best works of this great master are usually auctioned in New York and London.

Regarding the variables "authenticated", "provenance" and "*catalogue raisonné*", as explained above, the fact that the works of Miró considered in this study have been sold in the two most prestigious auction houses in the world, could have caused that these variables (that can be considered as authenticity measures of the works), were not significant. The variable "exhibited" was not significant either (similar to what was found by Stepanova, 2015, in the case of Picasso). On the other hand, the variable "literature" was significant. This result is consistent with what was reported by Stepanova (2015) in the case of Picasso. It seems that the market does pay particular attention to this variable, as well as to the number of words that have been dedicated in the catalog of the auction house when describing the respective lot.

With respect to the artistic periods, the works painted during the Anti-Painting and Organic period (1929 to 1935), which was omitted from the regression, were statistically more expensive than works executed during all other periods (Until 1919: Beginnings; 1920 to 1927: Catalan Fauvism, Mutation and Oneiric; 1936 to 1939: Monsters; 1940 to 1967: Internal Exile and Majorcan Stage; and 1975 to 1983: Transition to Democracy), except those painted during the period of 1968 to 1975 (Against the Francoism). These results highlight the importance of considering the works of the artists, in this case Miró's, according to the period in which they were painted. In the case of Picasso, studied by Stepanova (2015), the author found that only one of the eight periods of the artist from Málaga was statistically more expensive than the period omitted from the regression.

Figure 1 shows the evolution of the price index of Joan Miró between 2003 and 2017. The index was constructed from the coefficients of the dummy variables corresponding to each of the years of study in the regression presented in Table 5, performing the calculation e^{Y_t} for each of the estimated coefficients Y_t . It can be observed that the prices of Miró's works increased substantially between 2003 and 2008 (150% increase) and then, they experienced a considerable drop in 2009, in the context of the global financial crisis. Prices recovered in 2014 and 2015, but fell again in 2016.

Finally, we carried out the variance inflation test (VIF) to check if there were multicollinearity problems in the regression. The result obtained was 4.74; which indicates that there is apparently no problem of multicollinearity in the regression.

Lastly, it was analyzed if the place where Miró signed and dated his works affected their prices (front, back, on both sides, or on the edge of the artwork). None of these variables were significant, which concludes that the place where the work was signed or dated does not affect its price. It was also analyzed if the name of the auction affected the price (for example, "Impressionist & Modern Art", etc.), without obtaining evidence in favor of this hypothesis.¹

4. CONCLUSIONS AND POSSIBLE EXTENSIONS

Most of the studies referring to the attributes of art as an investment are based on the construction of price indices of artists from certain countries or artistic movements. However, we know relatively little about the investment attributes of the works of specific artists (except for the cases of Pablo Picasso and Andy Warhol, the two artists with the highest value of artworks traded in auction houses annually).

In this study it was determined that the paintings of Joan Miró are worth more when: they are painted on canvas, they are sold in Sotheby's and in New York or London, they are sold in the evening auction, their area is greater, if they have appeared in books or art catalogs, the number of words used to describe the respective lot in the auction catalog is greater, and the works belonging to each of the periods (except the period "Against the Francoism") were less expensive than those belonging to period that was omitted in the regression ("Anti-Painting and Organic").

This work can be extended by analyzing whether the effect of the color of Miró's artworks affects their prices. For example, in a recent paper Pownall and Graddy (2016) analyzed the impact of the intensity and luminosity of color on the prices of Andy Warhol's serigraphs sold at Christie's and Sotheby's in 2012. The authors found that the works that were more intense in colors tended to enjoy higher prices, once they controlled by a series of variables. Darkness was rewarded with a premium with respect to clarity. Finally, Stepanova (2015) analyzed the works of Pablo Picasso sold at Christie's and Sotheby's between 1998 and 2014 and determined that artworks having a greater contrast of colors were sold at higher prices, and that those containing certain ranges of blue and orange colors also tended to be sold at higher prices.

¹ These results were not reported in this paper to facilitate exposure, but can be sent to interested readers upon request.

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Table 1: Summary of art as an investment in studies that used the repeat sales method

Author(s)	Market(s)/Style(s)	Time Frame	Annual Real Return (%)	Standard Deviation (%)
Baumol (1986)	General	1652-1961	0.60	
Frey and Pommerehne (1989)	General	1635-1949	1.40	5.00
		1653-1987	1.50	
Buelens and Ginsburgh (1993)	General	1950-1987	1.70	3.00
		1780-1970	3.00	
Goetzmann (1993)	General	1716-1986	2.00	6.50
		1850-1986	3.80	
Pesando (1993)	Modern prints	1900-1986	13.30	5.19
		1977-1992	1.51	
Chanel, Gérard-Varet and Ginsburgh (1996)	General	1855-1969	5.00	
Goetzmann (1996)	General	1907-1977	5.00	
Pesando and Shum (1996)	Picasso's prints	1977-1992	2.10	23.38
Mei and Moses (2002)	USA, Impressionism and Great Old Masters	1875-1999	4.90	4.28
		1900-1986	5.20	3.72
		1900-1999	5.20	3.55
		1950-1999	8.20	2.13
		1977-1991	7.80	2.11
Renneboog and Spaenjers (2013)	General	1982-2007	4.56	15.79
Korteweg, Kraussl and Verwijmeren (2015)	General	1961-2013	6.28	11.35

(Nominal return)

Table 2: Summary of art as an investment in studies that used the hedonic pricing method

Author(s)	Market(s)	Time Frame	Annual Return	Standard Deviation (%)	
Agnello and Pierce (1996)	USA	1971-1992	9.30% (nominal dollars)	-	
Renneboog and Van Houtte (2002)	Belgium	1970-1989	8.40% (nominal Belgian francs)	19.40	
Higgs and Worthington (2005)	Australia	1973-2003	6.96% (nominal Australian dollars)	16.51	
Taylor and Coleman (2011)	Australian Aboriginal Art	1982-2007	6.60% (nominal Australian dollars)	17.90	
Kraussl and Logher (2010)	Russia	1985-2008	10.00% (nominal dollars)	26.53	
	China	1990-2008	5.70% (nominal dollars)	21.08	
	India	2002-2008	42.20% (nominal dollars)	36.87	
Renneboog and Spaenjers (2013)	World	1957-2007	3.97% (real dollars)	15.21	
Korteweg, Kraussl and Verwijmeren (2015)	General	1960-2013	8.72% (nominal dollars)	13.76	
	Australia	1971-2007	3.09% (real dollars)	21.15	
	Austria	1971-2007	2.53% (real dollars)	17.44	
	Belgium	1975-2007	-0.90% (real dollars)	17.41	
	Canada	1972-2007	2.36% (real dollars)	16.12	
	Denmark	1976-2007	1.75% (real dollars)	15.56	
	France	1971-2007	1.14% (real dollars)	18.94	
	Renneboog and Spaenjers (2014)	Germany	1971-2007	1.52% (real dollars)	13.12
		Italy	1971-2007	1.99% (real dollars)	17.67
		Netherlands	1971-2007	2.30% (real dollars)	17.94
		Sweden	1971-2007	2.32% (real dollars)	20.18
		Switzerland	1972-2007	1.99% (real dollars)	18.50
		Great Britain	1971-2007	4.60% (real dollars)	15.79
		USA	1971-2007	3.07% (real dollars)	14.31
	Edwards (2004)	Latin America	1981-2000	9.00% (real dollars)	12.60
	Campos and Barbosa (2009)	Latin America	1995-2002	5.23% (nominal dollars)	-
	Kräussl, Lehnert and Martelin (2016)	Latin America	1970-2013	6.11% (nominal dollars)	-
Garay, Vielma and Villalobos (2017)	Argentina	1980-2014	6.81% (nominal dollars)	29.11	

Source: Taken and adapted from Garay (2018).

Table 3: Summary of art as an investment by style/movement

Author(s)	Market(s)/Style(s)	Time Frame	Annual Real Return (%)	Standard Deviation (%)
Baumol (1986)	General	1652-1961	0.60	
Frey and Pommerehne (1989)	General	1635-1949	1.40	5.00
		1653-1987	1.50	
		1950-1987	1.70	
Buelens and Ginsburgh (1993)	General	1780-1970	3.00	
		1716-1986	2.00	
Goetzmann (1993)	General	1850-1986	3.80	6.50
		1900-1986	13.30	5.19
Pesando (1993)	Modern prints	1977-1992	1.51	19.94
Chanel, Gérard-Varet and Ginsburgh (1996)	General	1855-1969	5.00	
Goetzmann (1996)	General	1907-1977	5.00	
Pesando and Shum (1996)	Picasso's prints	1977-1992	2.10	23.38
		1875-1999	4.90	4.28
		1900-1986	5.20	3.72
		1900-1999	5.20	3.55
		1950-1999	8.20	2.13
Mei and Moses (2002)	USA, Impressionism and Great Old Masters	1977-1991	7.80	2.11
Renneboog and Spaenjers (2013)	General	1982-2007	4.56	15.79
Korteweg, Kraussl and Verwijmeren (2015)	General	1961-2013	6.28	11.35

(Nominal return)

Source: Taken and adapted from Garay (2018).

Table 4: Descriptive Statistics

Variable	Joan Miró				
	Number of paintings	Arithmetic Mean	Standard Deviation	Minimum	Maximum
Price	255	\$2.414.736	\$4.445.636	\$42.781	\$36.946.396
Technique and support					
Oil	163	\$3.050.366	\$5.146.751	\$99.304	\$36.946.396
Oil and others	81	\$1.275.300	\$2.464.873	\$42.781	\$14.866.500
Others	11	\$1.386.239	\$2.450.406	\$105.522	\$8.360.265
Canvas	148	\$3.603.129	\$5.425.884	\$102.096	\$36.946.396
Paper	38	\$550.809	\$503.194	\$42.781	\$2.772.500
Others	69	\$892.228	\$1.635.597	\$98.374	\$12.485.000
Characteristics of the auction					
Christie's	148	\$2.542.170	\$4.486.708	\$88.169	\$26.609.175
Sotheby's	107	\$2.238.471	\$4.403.104	\$42.781	\$36.946.396
New York	112	\$2.678.440	\$4.003.262	\$102.000	\$23.375.000
London	126	\$2.432.470	\$5.035.464	\$88.169	\$36.946.396
Paris/Madrid	17	\$545.950	\$523.851	\$42.781	\$2.040.316
Evening	156	\$3.689.978	\$5.303.243	\$42.781	\$36.946.396
Characteristics of the lots					
Dated	247	\$2.453.503	\$4.506.164	\$42.781	\$36.946.396
Signed	241	\$2.500.867	\$4.551.700	\$42.781	\$36.946.396
Area (Inches ²)	-	933,46	1.123,77	24,98	8.521,83
Lot number	-	162,20	165,06	3	711
Number of references in literature	-	2,13	2,69	0	30
Number of exhibitions	-	1,86	2,90	0	18
Provenance (number of owners)	-	3,38	1,92	0	13
Number of words	-	514,52	577,40	0	3.104
Catalogue Raisonné	203	\$2.692.338	\$4.711.677	\$47.073	\$36.946.396
Certificate of Authenticity	49	\$1.195.409	\$2.678.140	\$42.781	\$17.065.000
Artistic Period					
Beginnings	6	\$2.032.620	\$3.260.815	\$464.000	\$8.677.000
Catalan Fauvism, Mutation and Oneiric	26	\$4.995.048	\$8.494.655	\$152.176	\$36.946.396
Anti-Painting and Organic	18	\$3.698.715	\$6.362.032	\$108.000	\$23.375.000
Monsters	14	\$3.627.307	\$5.390.919	\$142.400	\$17.065.000
Internal Exile and Majorcan Stage	113	\$2.263.488	\$3.665.076	\$42.781	\$23.540.828
Against the Francoism	48	\$1.705.786	\$2.207.050	\$88.169	\$8.360.265
Transition to Democracy	30	\$622.651	\$748.082	\$98.374	\$2.909.000

Source: Own calculations based on information obtained from Christie's, Sotheby's and Blouin Art Sales websites.

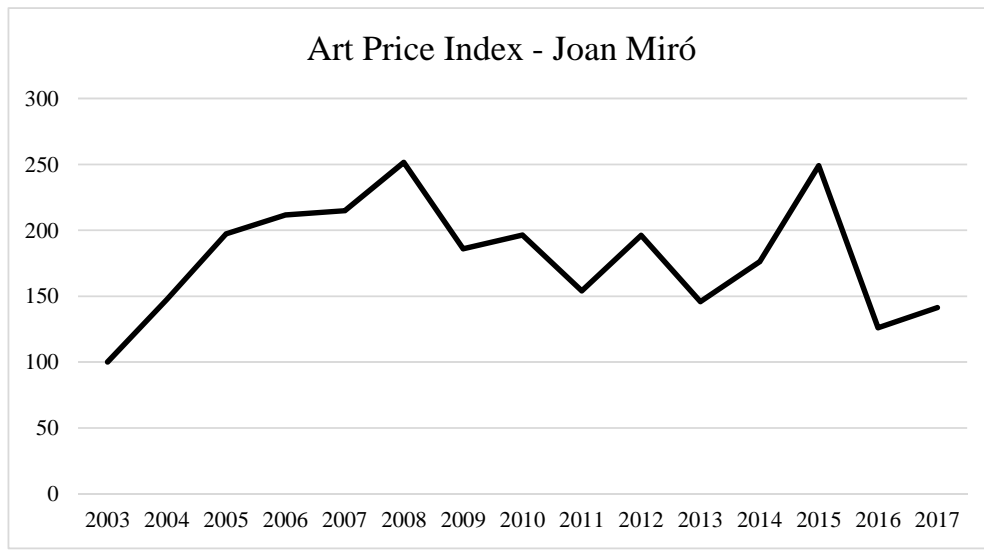
Table 5: Hedonic Regression Results and Price Impact

Variable	Coefficient	Standard Error	t	P > t	Price Impact (%)
Technique and support					
Oil	0,3149	0,3058	1,03	0,304	
Oil and others	0,2818	0,2863	0,98	0,326	
Others	0,0000		Omitted		
Canvas	0,3513	0,1011	3,48	0,001	42,10
Characteristics of the auction					
Sotheby's	0,3539	0,0946	3,74	0,000	42,46
New York	1,1537	0,2425	4,76	0,000	217,00
London	1,0675	0,2328	4,59	0,000	190,80
Paris/Madrid	0,0000		Omitted		
Evening	0,7139	0,1855	3,85	0,000	104,20
Characteristics of the lots					
Dated	0,0155	0,3422	0,05	0,964	
Signed	-0,1307	0,1824	-0,72	0,474	
Area (Inches ²)	0,0004	0,0001	4,31	0,000	0,04
Area squared (Inches ⁴)	-2,98E-08	1,33E-08	-2,25	0,026	0,00
Lor number	-0,0021	0,0014	-1,52	0,129	
Lot number squared	3,57E-06	1,87E-06	1,91	0,057	
Number of references in literature	0,0397	0,0155	2,55	0,011	4,05
Number of exhibitions	-0,0237	0,0165	-1,44	0,151	
Provenance (number of owners)	-0,0155	0,0230	-0,67	0,502	
Number of words	0,0011	0,0001	11,34	0,000	0,11
Catalogue Raisonné	-0,0100	0,1471	-0,07	0,946	
Certificate of Authenticity	-0,1160	0,1323	-0,88	0,382	
Artistic Period					
Beginnings	-0,5562	0,2361	-2,36	0,019	-42,66
Catalan Fauvism, Mutation and Oneiric	-0,4099	0,2123	-1,93	0,055	-33,63
Anti-Painting and Organic	0,0000		Omitted		
Monsters	-0,4708	0,2446	-1,92	0,056	-37,55
Internal Exile and Majorcan Stage	-0,2920	0,1585	-1,84	0,067	-25,32
Against the Francoism	-0,2077	0,1754	-1,18	0,238	
Transition to Democracy	-0,4943	0,1887	-2,62	0,009	-39,00
Year of the auction					
2003	0,0000		Omitted		
2004	0,3878	0,2682	1,45	0,150	
2005	0,6793	0,2744	2,48	0,014	97,25
2006	0,7500	0,3025	2,48	0,014	111,70
2007	0,7650	0,2810	2,72	0,007	114,91
2008	0,9221	0,2784	3,31	0,001	151,46
2009	0,6208	0,2827	2,20	0,029	86,04
2010	0,6747	0,2737	2,47	0,014	96,34
2011	0,4320	0,3326	1,30	0,195	
2012	0,6741	0,2690	2,51	0,013	96,22
2013	0,3777	0,2808	1,35	0,180	
2014	0,5661	0,2662	2,13	0,035	76,14
2015	0,9121	0,3048	2,99	0,003	148,94
2016	0,2310	0,3886	0,59	0,553	
2017	0,3466	0,3385	1,02	0,307	
Constant (Intercept)	1,0800	0,6011	17,97	0,000	
N = 255 ; R-squared = 0,8369					

Source: Own elaboration.

Note: In the hedonic model, the price impact is measured as: $e^{\beta_m} - 1$. The β_m coefficients of the dummy variables in the previous expression are interpreted following Halvorsen and Palmquist (1980).

Figure 1: Evolution of Joan Miró's Art Price Index (2003-2017)



Source: Own calculations based on information obtained from Christie's, Sotheby's and Blouin Art Sales websites.