



**Do the different expressions of an artist offer the same financial performance over time? The case of Fernando Botero**

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# Do the different expressions of an artist offer the same financial performance over time? The case of Fernando Botero

## Structured abstract

### Purpose

Art return indices are usually estimated based only on a few means of artistic expressions (mainly paintings and drawings). Other forms of expression (e.g., sculptures) are generally ignored. We analyze and compare the price determinants as well as the return and risk of three artistic expressions (paintings, drawings, and sculptures) executed by Fernando Botero.

### \* Design/methodology/approach

We analyzed all paintings, drawings and sculptures executed by Botero and sold at Sotheby's and Christie's between 2000 and 2020 (a total of 707 artworks, out of which 253 were paintings, 227 were drawings, and 227 were sculptures). A hedonic regression was run to explain the price of each artwork, and using explanatory variables that are standard in the literature.

### \* Findings

The performance of Botero's sculptures through time differs markedly from that of his paintings and drawings. While Botero's paintings provided a return that was comparable to those of his sculptures (3.36% and 3.20%, respectively), they were twice as high as those of his drawings (1.68%). In terms of risk, whereas paintings and drawings had similar annual standard deviations (26%, and 25.22%, respectively), sculptures had a much smaller standard deviation (16.96%).

### \* Originality/value

To the best of our knowledge, this is the first paper that compares the financial performance of paintings, drawings, and sculptures for the case of a specific artist.

**Keywords:** Art returns, alternative investments, hedonic pricing model, sculptures, Latin American art, and Fernando Botero.

**Management area:** Capital Markets and Banking

**Paper type:** Research paper

**JEL Codes:** G10, G11, and G12

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## ¿Las diferentes expresiones de un artista ofrecen el mismo desempeño financiero a lo largo del tiempo? El caso de Fernando Botero

### Resumen estructurado

#### Objetivo

Los índices de retorno del arte generalmente se estiman en función de unos pocos medios de expresión artística (principalmente pinturas y dibujos). Otras formas de expresión (por ejemplo, esculturas) generalmente se ignoran. Analizamos y comparamos los determinantes del precio, así como la rentabilidad y el riesgo de tres expresiones artísticas (pinturas, dibujos y esculturas) ejecutadas por Fernando Botero.

#### \* Diseño/metodología/enfoque

Analizamos todas las pinturas, dibujos y esculturas realizadas por Botero y vendidas en Sotheby's y Christie's entre 2000 y 2020 (un total de 707 obras de arte, de las cuales 253 eran pinturas, 227 dibujos y 227 esculturas). Se corrió una regresión hedonista para explicar el precio de cada obra de arte, utilizando variables explicativas estándar en la literatura.

#### \* Hallazgos

El comportamiento de las esculturas de Botero a lo largo del tiempo difiere notablemente del de sus pinturas y dibujos. Si bien las pinturas de Botero proporcionaron un rendimiento comparable al de sus esculturas (3,36 % y 3,20 %, respectivamente), duplicaron el de sus dibujos (1,68 %). En términos de riesgo, mientras que las pinturas y los dibujos tenían desviaciones estándar anuales similares (26 % y 25,22 %, respectivamente), las esculturas tenían una desviación estándar mucho menor (16,96 %).

#### \* Originalidad/valor

Hasta donde sabemos, este es el primer artículo que compara el desempeño financiero de pinturas, dibujos y esculturas para el caso de un artista específico.

**Palabras clave:** Retornos del arte, inversiones alternativas, modelo de precios hedónicos, esculturas, arte latinoamericano y Fernando Botero.

**Área de gestión:** Mercado de Capitales y Banca

**Tipo de trabajo:** Trabajo de investigación

**Códigos JEL:** G10, G11, and G12

Julio de 2023

## **Do the different expressions of an artist offer the same financial performance over time? The case of Fernando Botero**

### **INTRODUCTION**

Investors have discovered that art has characteristics that go far beyond the enjoyment of an artwork or its status, as art can offer significant diversification benefits and, therefore, risk reduction to a portfolio of traditional assets.

Art buyers include collectors (who purchase art mostly for the pleasure and status that it confers), as well as investors, attracted by the potential financial attributes of this asset class, such as diversification. Another relevant aspect is that art prices tend to fall less than other assets such as stocks during economic downturns (Garay, Molina, Puggioni and ter Horst, 2022).

This paper analyzes whether the different expressions of an artist (for example, paintings, drawings and sculptures) offer the same financial performance over time. We consider this question to be relevant because, until now, the existing literature has focused almost exclusively on the analysis of paintings and drawings to measure the performance of art as an investment asset, leaving aside the performance of other artistic manifestations, such as sculptures (see, for example, Worthington and Higgs, 2005, Taylor and Coleman, 2011, Renneboog and Spaenjers, 2013, and Garay, 2021). We study the determinants and the financial performance of the works executed by Fernando Botero, the Colombian master, to analyze this issue.

We chose Botero for three reasons. First, Botero is the Latin American living artist that has achieved the highest levels of international sales. His work has been studied along with the work of other renowned artists, opening the door to the need to deepen the specific analysis of his prolific work. Second, Botero is an artist who has worked extensively on various artistic expressions (oil paintings, drawings on different materials, and sculptures) throughout his life, a characteristic that is essential to be able to carry out our study. Third, there is a long record of auction sales for each of Botero's artistic expressions. We conduct our study based on hammer price data from auctions conducted at both Sotheby's and Christie's for the three artistic expressions mentioned above, and for the period between 2000 and 2020.

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3 The paper is organized as follows. The first section of the work contains the literature review. The  
4 second section presents the data and the methodology to be followed, while the third section offers  
5 an analysis of the results obtained. Finally, the conclusions of the work and the possible extensions  
6 are presented.  
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## 10 11 12 13 **1. LITERATURE OVERVIEW**

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15 Many authors agree that art prices reflect their value and quality (see, for example, Edwards, 2004,  
16 Coslor and Spaenjers, 2016, and Cinefra, Garay, Mibelli and Pérez, 2019), that is, the higher the price  
17 of a work of art, the higher its artistic quality. As an investment alternative, works of art represent  
18 the possibility of "enjoying" some additional benefits to traditional investments, such as the  
19 emotional value or the prestige that owning a work of art represents (Renneboog and Spaenjers,  
20 2013).  
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26 The attributes of art are not only reflected in the visual enjoyment, status or risk mitigation of a  
27 portfolio of traditional assets. Art can also generate positive real returns depending on art style,  
28 author, and artistic expression. For example, Renneboog and Spaenjers (2013) found an average  
29 positive real return of 3.97% per year between 1957 and 2007, and 5.19% per year between 1982 and  
30 2007. These returns were lower than those offered by other investments, like U.S. stocks, although  
31 investments in art provided substantial diversification benefits to investors in traditional assets.  
32 Renneboog and Spaenjers (2013), and Li, Ma, and Renneboog (2021) also estimated that the  
33 correlation of art and other assets was low, and even negative in some cases. Investing in an artwork  
34 can provide a significant degree of diversification by exhibiting low correlations with stocks and  
35 bonds. In this regard, Dimson and Spaenjers (2013) also found a low correlation between art and  
36 stocks (0.22), art and Treasury Bills (0.23), and art and U.S. bonds (0.08). These results are in line  
37 with those found by Pesando (2001).  
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47 Mei and Moses (2002) compiled an annual price index based on repeated auction sales of works of  
48 art between 1875 and 2000 and found that the annual compound real return on investment in art was  
49 8.20%, this is higher than that of bonds and treasury bills, but lower than the S&P 500 and Dow Jones  
50 (8.90% and 9.1%, respectively). Pesando (1993) estimated a price index for repeated sales of modern  
51 print auctions for the period 1977-1992, finding that the real annual return of the aggregate print  
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3 portfolio was 1.51%, while the real return corresponding to the prints of Pablo Picasso was slightly  
4 higher (2.10%). Both returns were lower than the average real return on treasury bills (2.23%), long-  
5 term bonds (2.54%), and stocks (8.14%). The risk of investing in portfolios of prints was like that of  
6 investments in equities and long-term bonds. The result of the annual real return of impressions  
7 contrasts with that expressed by Mei and Moses (2002). Pesando (1993) also found positive real  
8 returns for art. For the case of Latin American artists, Campos and Barbosa (2008) estimated a  
9 hedonic price index for 1.663 paintings executed by Latin American artists based on auction prices  
10 from Soterby's in New York between 1995 and 2002, finding that the average annual return was of  
11 5.23%.

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Garay (2018) presents a summary of the literature on the financial performance of art and concludes that: 1) the real rate of return of investing in artworks has been positive, although modest in most cases. 2) In general, the estimated return of art investments is below the return offered by stocks and, often, similar to the returns recorded by government bonds (although with higher risk levels than those of bonds and similar to those of stocks). 3) The correlation between art returns and stocks, bonds, and most alternative investments tends to be low, thus suggesting that art offers diversification benefits to investors having allocations to such assets.

There are very few studies related to sculptures as an investment alternative to painting and drawings. One of these studies was conducted by Vosilov (2015a), who found that sculptures presented a positive real annual average return of 2.1% between 1985 and 2013, with a standard deviation of 15.54%. Vosilov (2015a) also found that the main determinants of the price of a sculpture are: its volume, if the artist had already passed away at the time of the sale of the work at auction, if the sculpture was signed, the material used (bronze, iron, steel, ceramic, wood and other materials) and, finally, the auction house where the work was sold and its location. Sculptures had a very low correlation with U.S. stocks (0.074), and slightly negative with U.S. bonds (-0.127).

As commented at the beginning, this study analyzes whether the different expressions of an artist offer the same financial performance over time. We consider this question to be important because, until now, the literature has focused almost exclusively on the study of paintings and drawings to measure the performance of art as an investment asset, leaving behind hand the performance of other artistic manifestations, such as sculptures. Thus, when estimating the performance offered by the works of a certain artist, the calculations are made considering only paintings and drawings, and

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3 sometimes prints or other types of multiple works. Such an approach ignores the financial  
4 performance of other artistic expressions (for example, sculptures, ceramics, installations, etc.), and  
5 thus it is possible that they introduce a bias in the estimation of art returns. As mentioned above,  
6 Botero represents an excellent opportunity to analyze this question, considering that he has been a  
7 prolific artist in various artistic expressions and that, in addition, his works have had a very active  
8 market in auctions, for several decades now.  
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14 In this paper, the determinants of the prices of Fernando Botero's paintings, drawings and sculptures  
15 between the years 2000 and 2020 are found through a regression of hedonic prices estimated by  
16 ordinary least squares of the works auctioned at Sotheby's and Christie's. Subsequently, from the  
17 estimated coefficients of the regression corresponding to the dummy variables of each year, price  
18 indices will be estimated for each artistic expression (paintings, drawings, and sculptures), and the  
19 performance and risk that each of them has offered will be compared. Finally, the nominal and real  
20 performance of each of Botero's artistic expressions will be compared to other traditional investment  
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29 Fernando Botero (born on 1932) is a Colombian figurative artist and sculpture whose style is  
30 characterized by depicting people and figures in exaggerated volumes. He is regarded as the most  
31 recognized and quoted living artist from Latin America ([https://www.dailyartmagazine.com/10-](https://www.dailyartmagazine.com/10-facts-you-need-to-know-about-fernando-botero)  
32 [facts-you-need-to-know-about-fernando-botero](https://www.dailyartmagazine.com/10-facts-you-need-to-know-about-fernando-botero)). The prices of certain artistic expressions by  
33 Fernando Botero have been analyzed on previous occasions. For example, Garay, Pérez and Pulga  
34 (2022) analyzed the impact of the intensity of colors of the works of the "Big Five" of Latin America  
35 (Diego Rivera, Rufino Tamayo, Roberto Matta, Wilfredo Lam, and Fernando Botero), on the prices  
36 of their paintings and drawings sold at public auctions, finding that the greater the intensity in the  
37 colors of the works of these artists, the higher the sale price of those works tends to be at auctions  
38 held by Sotheby's and Christie's, and that this effect is only up to a certain point, after which art prices  
39 start to decline as color intensity increases.  
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## 51 **2. DATA AND METHODOLOGY**

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53 Two methodological models have been used for estimating the price determinants of works of art:  
54 the repeat sales model and the hedonic price model. The repeat sales model analyzes the price return  
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of artworks that have been sold at least two times in a database. The advantage of this method is that the same work is being used to calculate returns and, thus, the returns are based on a homogeneous good. However, only a small fraction of all the artworks sold correspond to repeat sales and, thus, a major disadvantage of this method is that it can only be estimated for a small sample of the database.

The works of art are, in essence, unique, due to their creative and artistic characteristics among others, which in theory makes them incomparable. As proposed by Rosen (1974), the hedonic price model consists of two stages, the first involving the estimation of the implicit prices of each of the attributes of a good (in the case of a painting, for example, whether it is signed and dated, its area, etc.). The second stage consists of estimating the supply and demand functions for each of the characteristics of the good. As there is no data available on the socio-economic factors of the consumers of works of art, the researchers have assumed that the market is in equilibrium and therefore that the supply and demand are equal, which then allows to carry out the second stage of the hedonic price model (Garay, 2018). The following are some of the studies that have applied the hedonic pricing method to estimate art investment returns: Buelens and Ginsburgh (1993), Agnello and Pierce (1996), Worthington and Higgs (2005), Taylor and Coleman (2011), Renneboog and Spaenjers (2013), Stepanova (2015), Pownall and Grady (2016), Garay, Vielma and Villalobos (2017), Garay (2021), and Li, Ma, and Renneboog (2021).

We used all paintings, drawings and sculptures executed by Botero and sold at Sotheby's and Christie's between 2000 and 2020. This information was obtained from their respective websites ([www.sothebys.com](http://www.sothebys.com) and [www.christies.com](http://www.christies.com)). We chose to use data from only these two auction houses, not only because they are very prestigious, but also due to the robustness of the auction information that they provide, as they are among of the few auction houses that consistently report variables such as: whether the work has appeared in art books, if the work has been exhibited, and others. A total of 707 sales of Botero's works were recorded from these two auction houses between 2000 and 2020.

Next, we proceeded to run an ordinary least squares regression to estimate the price determinants of each of the three considered artistic expressions of Botero (paintings, drawings, and sculptures), including the coefficients from the year of the sale-dummy variables (which will be used to construct a price index for each artistic expression). The following is the baseline equation for each artistic expression (there are three artistic expressions and, therefore, three estimated regressions):



$$\text{Ln}(\text{Price}_{kt}) = \alpha + \sum_{n=1}^n \beta_n \times \text{Variable}_{nkt} + \sum_{t=2}^T \delta_t \times D_t + \varepsilon_{kt} \quad (1)$$

Where:

- The price (in logarithm) of lot  $k$  (either a painting, a drawing or a sculpture, depending on the regression) executed by the artist Fernando Botero, and sold at auction in year  $t$  (this is the dependent variable).
- $\text{Variable}_{nkt}$ : value of the characteristic  $n$  of the work  $k$  at time  $t$
- $\beta_n$ : Relative price coefficient of the variable  $n$ , calculated through the regressions for each type of artistic expression.
- $D_{mt}$ : Dummy variable whose value is equal to 1 if the transaction occurs in year  $t$  and zero for any other year between 2000 and 2020.
- $\delta_t$ : Relative price coefficient of the variable  $n$ , calculated through the regressions for each type of artistic expression.
- $\alpha$ : Independent term of each regression
- $\varepsilon_{kt}$ : is the regression error for work  $k$  at time  $t$ . It is assumed to be distributed as a normal variable with zero mean and sigma variance.

The hedonic pricing model is estimated through a regression model in which the dependent variable is the price of each painting at each point in time. The model starts from the premise that the market valuation of each attribute remains constant over time. It's most relevant advantage to us is that it allows the use of the information on all the sales in the database. A log-transformation of prices (the dependent variable) is often used in order to mitigate the potential effects of outliers (considering that some artworks are sold for only a few thousand dollars, whereas others are sold in the tens of million-dollar range). The use of log-prices for the dependent variable in hedonic regressions is almost unanimous in the literature, e.g., Coleman and Taylor (2011); Buelens and Ginsburgh (1993); Agnello and Pierce (1996); Worthington and Higgs (2005); Taylor and Coleman (2011); Renneboog and Spaenjers (2013), Stepanova (2015), Pownall and Grady (2016), Garay (2017 and 2022), and Li, Ma, and Renneboog (2021).

Equation (1) has been estimated in the literature by a number of authors running an Ordinary Least Squares (OLS) regressions (e.g., Edwards, 2004; Worthington and Higgs, 2005; Campbell, 2008;

Campos and Barbosa, 2008; Kraeussl and Logher, 2010; Taylor and Coleman, 2011; Renneboog and Spaenjers, 2013; Stepanova, 2015; Pownall and Graddy, 2016; Garay et al., 2017, and Li, Ma, and Renneboog, 2021). The OLS contains fixed effects with respect to both time and cross-sections. It should be noted that individual effects are not present because the  $k$ -th artwork auctioned at time  $t$  is not necessarily the same as the  $k$ -th artwork sold at time  $t'$ , where  $t' = t$ .

The independent variables of the regressions are the following: Color-related variables (applies to paintings and drawings), technique: For paintings (oils) and drawings, materials (applies only to sculptures), auction house, auction city, whether the work is signed, if the work is dated, age of Botero when making the work, volume (cm<sup>3</sup>, applies to sculptures) or area (cm<sup>2</sup>, applies to paintings and drawings), volume<sup>2</sup> (cm<sup>6</sup>) or area<sup>2</sup> (cm<sup>4</sup>), if the work appears in art books, if the work has been exhibited, if it has provenance, if the work appears in Botero's *catalogue raisonné*, the edition number of the work (sculptures), the total number of editions (sculptures), if the work is a single edition (sculptures), if the work is an artist's proof (sculptures), the number of words used in the catalog note to describe it (if it has one), number of words in the catalog note<sup>2</sup>, if the work has a certificate of authenticity, if the work was sold at the evening auction, the support of the work, the subject of the work, and the year the work was sold. The color variable does not apply to sculptures, as their color is determined by the materials (another independent variable) used to create them. The Appendix presents a detailed description explaining how each of the independent variables was measured.

For the construction of the price indices of each of Botero's artistic expressions, once the coefficients  $\delta_t$  have been calculated, the anti-logarithmic function is applied to determine the art price index as a function of  $t$ , as follows (see Renneboog and Spaenjers, 2013):

$$\Pi_t = e^{\delta_t} \times 100$$

The coefficient value is equal to zero for the reference year, and then the estimated return for year  $t$  is calculated, in percentage terms, according to the following equation:

$$r_t = n \ln \left[ \frac{\Pi_t}{\Pi_{(t-1)}} \right] \times 100 = (\delta_t - \delta_{t-1}) \times 100$$

The construction of the index is carried out using the geometric mean of prices instead of the arithmetic mean, due to the calculation of the logarithmic transformation prior to the estimation that was commented before.

### 3. RESULTS

Table 1 shows the descriptive statistics for paintings, drawings, and sculptures shown by color-related variables, technique (materials, in the case of sculptures), lot features, support (paintings and drawings), and topic. The average prices of paintings and sculptures were very close (\$462,914; and \$456,988, respectively), and were much higher than the average price of drawings (\$95,763).

Here, we comment briefly on some of the main results arising from Table 1. The color-related variables indicate that the color of the average painting is more intense than the color of the average drawing, as the former tend to have lower values of R, G, B, L, and grayscale than the later (see the Appendix for a description of these variables). Whereas the average price of paintings sold at Sotheby's and Christie's is very similar, is slightly higher for drawings sold at Sotheby's, compared to Christie's. Paintings and drawings executed by Botero and sold in New York City tend to be marginally more expensive than those sold in other cities. Whereas being dated seems to add slightly more value to a painting or to a drawing, being signed does not appear to make a meaningful difference. The average area of a painting is about three times as large as the average area of a drawing. Paintings and drawings that have appeared in artbooks and art catalogues (literature), that have been exhibited at museums and galleries, and that are sold at the evening auction (considered to be the most prestigious one), tend to have substantially higher prices. Paintings having provenance have higher average prices, but there does not seem to be such an effect in the case of drawings. The average number of words used to describe a lot is almost ten times as large for the case of paintings compared to drawings. Finally, the certificate of authenticity is associated with a lower price for drawings and does not seem to affect the price of drawings. The surprising results in the case of paintings may be explained by the fact that paintings by Botero offered at auction at Sotheby's and Christie's are regarded as authentic, considering these are the two of the most prestigious auctions houses, and that, therefore, presumably a certificate of authenticity does not add extra information. Finally, paintings and drawings on canvas support have higher average prices, and the most expensive topic is people.

In the case of sculptures, the most expensive lots tend to be made of bronze and dark brown patina, followed closely by bronze, are sold at Christie's, in New York City, are dated (signed pieces are only marginally more expensive), have appeared in artbooks and catalogues, have been exhibited at museums and art galleries, have provenance, are an artist proof, are sold at the evening auction, and

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3 belong to the topic “nude and animals”. Surprisingly, sculptures by Botero that are single editions  
4 have a lower average price. This can be explained by the fact that the majority of single editions are  
5 made from marble, which is a material that is less expensive than bronze and bronze and dark patina  
6 (these two categories that account for 70% of all the sculptures), and that Botero’s sculptures made  
7 from marble have less volume.  
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#### 15 Price determinants of print, drawings, and sculptures for Botero

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17 Table 2 presents the results of the regression for Fernando Botero’s artistic expressions sold between  
18 2000 and 2020. The adjusted R-squares of the three regressions are satisfactory (0.72, 0.66, and 0.72  
19 for the regressions for paintings, drawings, and sculptures, respectively). The regression coefficients  
20 were estimated using heteroskedasticity-robust standard errors (White standard errors). Columns in  
21 dark gray correspond to paintings, middle gray to drawings, and lightest gray to sculptures.  
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26 Regarding the *color*-related variables, in the case of paintings, less intense colors of green and blue  
27 are associated to higher prices. However, in the case of drawings, the opposite result is found, that is,  
28 collectors reward the intensity of the colors red, green, and blue with a positive effect on prices (this  
29 finding for drawings is in line with Pownell and Graddy, 2016 and Garay, Pérez and Pulga, 2022).  
30 Opacity is valued in the case of paintings, but not in the case of drawings, where colors closer to white  
31 are preferred. Luminosity is another important factor, more luminosity has a positive effect in prices  
32 for the case of paintings, increasing its value by less than 1%. In the case of drawings, there are mixed  
33 results: the LABL and LABA vectors have positive effects on the price of 1.80% and 3.90%  
34 respectively. However, the LABL vector had a negative effect of 1.36%.  
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43 Regarding the *Technique* used, a painting is executed in oil is worth 65.34% more than the category  
44 oil and others, which was left out. In the case of drawings, those executed using charcoal and others,  
45 pastel and others, and watercolors and others (watercolor and others), had prices that were 40.91%,  
46 60.47% and 34.77%, higher, respectively, than the category others. In the case of sculptures, those  
47 that are made of bronze, bronze and dark brown patina, and bronze and brown patina, have a positive  
48 effect on the price, compared to the category “others”, of 61.50%, 50.45%, 94.04% and 59.72%,  
49 respectively. Sculptures made of marble increase their prices by 188.89%, being the second variable,  
50 after the subject of people, which helps increase the price of a sculpture the most.  
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3 With respect to the *lot features*, we found the following general results. When the results of the  
4 different regressions are analyzed for each of Fernando Botero's artistic expressions (painting,  
5 drawings and sculptures), it can be noted that the *Dated* variable positively impacts the price of  
6 paintings by 35.99% (the price of a painting increases by this percentage if a painting is dated, keeping  
7 the other variables constant).<sup>1</sup> However, this variable was not significant in the case of drawings and  
8 sculptures. Along the same lines of ideas, the *Literature* variable was only significant, and impacted  
9 the price by 5.42% more, for the case of paintings. When an artwork is auctioned at the main auction  
10 (the *evening* auction), it is worth 28.36% more in the case of paintings, and 22.02% if it is a sculpture,  
11 being not significant in the case of drawings. The *number of words* used in the catalog note or auction  
12 house report to describe a lot has a positive and significant effect on the price of paintings (each  
13 additional word adds 0.14% to the value of a painting), but it is not significant in the case of sculptures  
14 and drawings. The *number of words squared* is also only significant (and negative) in the case of  
15 paintings, meaning that the effect of the number of words used to describe a lot in the auction  
16 catalogue decreases as the number of words increases.  
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19 Continuing with lot features, the prices of paintings and drawings increase as the *area* (length x width)  
20 increases, but they do so at a decreasing rate (the variable *area squared* has a negative and significant  
21 sign). A similar result was obtained for sculptures, where its price increases as the *Volume* (in cm<sup>3</sup>)  
22 increases, but at decreasing rate (the variable *volume squared* has a negative and significant sign).  
23 When a painting appears in the *catalogue raisonné* of Botero, its price increases by 27.09%. The *city*  
24 *of New York* as an auction center turned out to significantly impact the price of Botero's sculptures  
25 (unlike the case of paintings and drawings), adding a premium of 22.23% compared to sculptures that  
26 are auctioned at other cities. There was no statistical difference in the prices of lots sold at *Christie's*  
27 and *Sotheby's*. The paintings and drawings executed by Botero later in his life tended to be more  
28 expensive (this result is consistent with the findings of Garay, Pérez and Pulga, 2022, also for Botero).  
29 However, this *age* effect was not present for the case of his sculptures.  
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32 The variable *total editions* (which only applies to sculptures) resulted in a negative impact on the  
33 price of 5.56%, indicating that the greater the number of editions, the lower the prices of the work  
34 will be. The *artist's proof* turned out to have a significant effect on the price of the work, increasing  
35 its value by 30.20%, indicating that initial or trial sketches of a sculpture are worth more than the  
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<sup>1</sup> The price impact of each hedonic variable is measured as  $e^{\beta} - 1$  (Renneboog and Spaenjers, 2013).

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3 finished and final sculpture. This is consistent with the idea that an artist's sculpture proof has an  
4 inherently unique element that confers them value, and it is an important result, as we have not been  
5 able to find any other paper measuring the effect of artist's proofs on the price of sculptures in the  
6 literature. The variables *provenance* and *certificate of authenticity* were not significant. In the case of  
7 drawings, drawings on a canvas *support* (canvas) have more value than those that are on paper and  
8 other supports, the former would be worth 33.70% more, and the latter 37.34% less, respectively.  
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11 It is important to note that, in the case of paintings and sculptures, the variables that most strongly  
12 affect the price are the *topic* of the works. If the central topic, theme, or composition of the work is  
13 people, this has the most important price premium in the case of paintings (with 122.82% more), and  
14 in the case of sculptures (with 202.12% more), not being significant in the case of the drawings. When  
15 the work is a portrait or self-portrait, it is worth 119.01% more, whereas if the subject is nudes, the  
16 premium is 100.73%, and if the topic is urban or religion it is worth 76.36% and 72.32% more,  
17 respectively. Similarly, if the main topic of a sculpture topic is animals, nude, and nude and animals,  
18 they are worth 130.21%, 141.41% and 161.51% more, respectively.  
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21 Finally, we estimated the variance inflation factor (VIF) to test for the possible presence of  
22 multicollinearity in the regressions. VIF values for the regressions were 3.52, 3.69, and 5.24 for  
23 paintings, drawings, and sculptures, respectively. These values are relatively low, and thus suggest  
24 that multicollinearity does not seem to be a problem, as the associated independent variables have a  
25 low level of collinearity with the other variables in each model.  
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#### 28 29 30 31 32 33 34 35 36 37 38 39 40 Performance of paintings, drawings and sculptures (2000-2020) 41

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43 Next, we constructed price indices for each of Botero's artistic expressions to compare their  
44 performance, using the coefficients of the year-dummy variables, as explained before, for the period  
45 2000-2020. Table 3 shows that different artistic expressions can have quite different financial  
46 performance. More specifically, when analyzing the artworks of Botero, we find that his paintings  
47 offered a return that was comparable to those of his sculptures (3.36% and 3.20%, respectively), but  
48 twice as high as those of his drawings (1.68%), being this last return statistically smaller (at the 5%  
49 level) to the previous two. In terms of risk, whereas paintings and drawings had similar annual  
50 standard deviations of returns (26%, and 25.22%, respectively), sculptures had a much smaller  
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3 standard deviation (16.96%), being this last number statistically smaller (at the 1%) to the previous  
4 two. These results led sculptures to command the ranking in terms of Sharpe ratios (0.10), followed  
5 by paintings (0.07), and drawings (0.01). Finally, whereas paintings and sculptures offered returns  
6 that were slightly above inflation, drawings were not able to offer positive real returns.  
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11 Figure 1 shows the evolution of the three art price indices, as well as those of U.S. stocks and bonds  
12 for the period considered. It becomes clear that sculptures exhibited a much lower standard deviation  
13 than paintings or drawings and offered a return/risk relation that was comparable to that of U.S. bonds.  
14 The prices of paintings and drawings increased at a faster pace during the first half of the sample  
15 period, the stabilized and finally declined. In terms of returns, paintings and drawings were  
16 overperforming U.S. stocks until 2016. Following that year, stocks shut up, and paintings and  
17 drawings declined.  
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24 Table 4 shows the returns' correlation matrix for the assets considered. The correlations between  
25 sculptures (an artistic expression that is usually not considered when estimating the returns to art),  
26 and paintings and drawings is very low (only 0.13 and 0.25). In turn, the correlation between paintings  
27 and drawings, two artistic expressions that are often used when estimating the returns of an artist or  
28 a movement, are relatively higher (0.69). Once again, these results highlight the importance of  
29 considering all the artistic expressions when evaluating the financial performance of an artist.  
30 Interestingly, sculptures had a relatively high correlation with the traditional assets considered  
31 (correlation of 0.71 with U.S. stocks and 0.77 with U.S. bonds). The correlations of paintings and  
32 drawings with traditional assets were much lower, and even slightly negative.  
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## 42 **5. IMPLICATIONS, CONCLUSIONS AND FUTURE RESEARCH**

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45 Art returns have been usually estimated in the literature based on only the performance of paintings  
46 and drawings and ignoring the financial performance of sculptures and other artistic expressions. In  
47 this paper, we analyzed the return and risk of three artistic expressions (paintings, drawings and  
48 sculptures) executed by Fernando Botero, the most expensive living Latin American artist (707  
49 artworks sold at auction at Christie's and Sotheby's between 2000 and 2020), and found that the  
50 financial performance of his sculptures differed markedly from the performance of his paintings and  
51 drawings.  
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3 More specifically, while Botero's paintings provided a return that was comparable to those of his  
4 sculptures (3.36% and 3.20%, respectively), they were twice as high as those of his drawings  
5 (1.68%). In terms of risk, whereas paintings and drawings had similar annual standard deviations of  
6 returns (26%, and 25.22%, respectively), sculptures had a much smaller standard deviation (16.96%).  
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8 Our results indicate that art returns estimated in the literature may suffer from a bias, as they have  
9 usually ignored the financial performance of sculptures and other artistic expressions. Also, whereas  
10 the prices of sculptures executed by Botero increased modestly, but steadily and with relatively little  
11 fluctuation during the sample period (2000-2020), the prices of his paintings and drawings increased  
12 at a faster pace during the first half of the sample period, then somewhat stabilized, and finally  
13 declined. In terms of returns, paintings and drawings.

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21 Through the present work, we were also able to identify the price determinants for the artistic  
22 expressions of Fernando Botero following the methodology of hedonic regressions and grouping the  
23 variables in the following six categories: Color-related variables, technique, materials, lot specific  
24 variables, support, and topic. We also constructed a price index for each artistic expression of Botero.  
25 Its accumulated annual return was like the return provided by the 10-year US Treasury bonds and  
26 below that of the S&P 500. As a diversification tool, paintings and drawings would have made a  
27 positive contribution to an investment portfolio, while sculptures would have offered a limited  
28 contribution.

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36 The requirement for a sizable and varied sample to determine the true impact of each variable on the  
37 price of a good is a drawback of the hedonic regression method. Another limitation is that since  
38 auctions are the only thorough source of publicly accessible art price data, we were only able to  
39 utilize auction prices for our analysis. All research using the hedonic pricing model has these two  
40 drawbacks in common.

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45 Our results have practical applications for art collectors and investors, as well as for galleries, artists,  
46 and, in general, for the whole art market. The risk and return attributes of the different artistic  
47 expressions of an artist can be different, and thus it makes sense to analyze each one of them  
48 individually, as well as their correlations with the other artistic expressions, and with traditional and  
49 other alternative investments.  
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3 The so-called "orange economy" includes the art sector. According to the World Bank, despite the  
4 importance of cultural, creative, and artistic endeavors for our sense of wellbeing, the economic  
5 benefit of the creative sector is still underappreciated.  
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9 An extension to our study would be to analyze the case of another artist, as a robustness analysis of  
10 the results obtained. We would need to work with an artist who has a large enough number of  
11 paintings, drawings and sculptures sold at auction over a long period of time, something that is not  
12 easy to find.  
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16 Also, Garay, Molina, Puggioni, and Ter Horst (2022) apply a Bayesian dynamic estimation of the  
17 hedonic regression model in which the estimated coefficients are time-varying and apply it to art  
18 prices. Our study could be extended to analyze the degree to which the coefficients estimated here  
19 are time-varying.  
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## Appendix: Description of each variable of the model

These variables have been obtained from: Worthington and Higgs (2005), Taylor and Coleman (2011), Renneboog and Spaenjers (2013), Vosilov (2015a and 2015b), Pownall and Grady (2016), Stepanova (2017), and Garay, Pérez and Pulga (2022).

Dependent variable - Price: Expressed in natural logarithm. It is the price paid by the buyer and includes costs and commissions charged by the auction house. For each of the three base regressions, the dependent variable is the natural logarithm of the price of: 1) paintings, 2) drawings, and 3) sculptures, executed by Fernando Botero.

Independent Variable 1 - Color (Applies to paintings and drawings): The image corresponding to each artwork is processed in order to quantify the intensity and content of each color code, according to the Pantone scale. The values of red, green, blue, (RGB), L, a, b (Lab Model), and grayscale for each work is analyzed.

Independent Variable 2 - Technique: For paintings (oil): The variable is equal to 1 if the work was executed using only oil, and zero in any other case. For drawings: the techniques are: watercolors in combination with other materials, graphite, graphite in combination with other materials, pastel in combination with other materials, charcoal in combination with other materials, and other techniques.

Independent Variable 3 - Materials (applies only to sculptures): bronze, bronze and dark patina, bronze and brown patina, bronze combined with other materials, marble, other materials.

Independent Variable 4 - Auction House: If the work was sold at Sotheby's, the dummy variable takes the value of 1, and it takes the value of zero if it was sold at Christies.

Independent Variable 5 - Auction City: It specifies whether the work was sold in New York City or in another city -Paris, Tokyo, or London-).

Independent Variable 6 - Signed: This dummy variable takes the value of 1 if the work was signed by Botero (either on the front, on the back or in other part in the case of the sculptures), and zero if it was not signed. This variable was not included in the final regression.

Independent variable 7 - Dated: This variable takes the value of 1 if the artwork has the date in which it was executed, and zero otherwise.

Independent Variable 8 - Natural logarithm of the artist's Age: This variable indicates the age (in natural logarithm) of Botero at the time he executed an artwork.

Independent Variable 9 - Volume (cm<sup>3</sup>) / area (cm<sup>2</sup>): the product of the dimensions of the work (height x width for paintings and drawings, and height x width x depth for sculptures), expressed in square centimeters for paintings or drawings, and in cubic centimeters for sculptures.

Independent Variable 10 - Volume<sup>2</sup> (cm<sup>6</sup>) / area<sup>2</sup> (cm<sup>4</sup>): This is the previous variable squared to identify whether there is a concavity in the curve.

Independent Variable 11 - Literature: This variable indicates if the work had been published in an artbook or art catalogue (as indicated by Sotheby's or Christie's), and the number of times.

Independent Variable 12 - Exhibition: It indicates if the work had been exhibited at a museum or art gallery (as indicated by Sotheby's or Christie's), and the number of times.

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3 Independent Variable 13 - Provenance: This variable indicates the number of owners that the work  
4 had up to the time of the auction sale.  
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6 Independent Variable 14 - Catalog Raisonné (it applies only to paintings): This dummy variable takes  
7 the value of 1 if a painting appears in Botero's catalogue raisonné, as stated by Sotheby's or  
8 Christie's, and zero otherwise.  
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10 Independent Variable 15 - Edition Number (it applies only to sculptures): This variable indicates the  
11 number of the edition of a sculpture (e.g., 2 of 3, 1 of 5, etc.).  
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13 Independent Variable 16 - Total Editions (it applies only to sculptures): This variable indicates the  
14 number of the editions of a sculpture (e.g., 3, 5, etc.).  
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16 Independent Variable 17 - Single Edition (it applies only to sculptures): This variable takes the value  
17 1 if the sculpture is unique and zero otherwise.  
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19 Independent Variable 18 - Artist's Proof (it applies only to sculptures): This is a dummy variable that  
20 takes the value of 1 if a sculpture is an artist proof, and zero otherwise.  
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22 Independent Variable 19 - # Number of words: indicates the number of words used by the auction  
23 house to describe the lot.  
24

25 Independent Variable 20 - # Number of words<sup>2</sup>: It is the previous variable squared.  
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27 Independent Variable 21 - Certificate of Authenticity: This dummy variable takes the value of 1 if  
28 the work presents a certificate of authenticity and zero in any other case.  
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30 Independent Variable 22 - Evening: This variable takes the value of 1 if the lot was sold at the evening  
31 auction, and zero otherwise.  
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33 Independent Variable 23 – Support (for canvas paintings and drawings). The variable is equal to 1 if  
34 a painting was made on canvas and zero for any other case. For drawings, the observed supports were  
35 paper, canvas and others.  
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37 Independent Variable 24 - Topic: This variable refers to the topic or theme of an artwork. The topics  
38 for paintings and drawings were people, still life, portraits and self-portraits, religion, and nudes,  
39 urban or other without title. For sculptures, they were animals, nudes, people, nudes with animals,  
40 and others. This classification uses the same topics employed by Renneboog and Spaenjers (2013),  
41 and by Garay, Pérez and Pulga (2022).  
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43 Independent Variable 25 - Auction year: this dummy variable identifies the year in which the auction  
44 was held. Because the number of works auctioned on each year between 2000 and 2003 was low, a  
45 variable was constructed that considered the years 2000 to 2003 as a single year. This variable takes  
46 the value of 1 if the auction sale occurs in the year of that auction, and zero if it occurred in any other  
47 year.  
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Table 1. Descriptive statistics for paintings and drawings

Paintings				Drawings			
Variable	Number of paintings	Arithmetic mean (US\$)	Standard dev. (US\$)	Variable	Number of drawings	Arithmetic mean	Standard deviation
Price	253	462.914	391.827	Price	227	95.763	108.502
<b>Color (values of each variable)</b>				<b>Color</b>			
Red		131.92	37.91	Red		193.47	44.19
Green		114.63	34.98	Green		182.70	48.28
Blue		89.92	33.97	Blue			
HSV:H				HSV:H			
HSV:S		38.35	14.90	HSV:S		17.68	13.96
HSV:V		54.16	14.62	HSV:V		76.30	17.00
LCH:L		48.85	13.75	LCH:L		74.12	18.02
LCH:C		22.33	10.44	LCH:C		12.26	9.06
LCH:H				LCH:H			
LAB:L		48.85	13.75	LAB:L		74.12	18.02
LAB:A		4.08	7.08	LAB:A		1.33	4.54
LAB:B		16.33	11.22	LAB:B		10.93	8.24
Grayscale		116.97	34.05	Grayscale		183.83	46.96
<b>Technique</b>				<b>Technique</b>			
Oil	239	476.824	397.328	Graphite	66	46.171	37.087
Oil & Others	14	225.452	146.901	Graphite & Others	30	51.384	44.738
<b>Lot features</b>				<b>Lot features</b>			
Sotheby's	98	462.017	381.931	Charcol & Others	32	183.248	159.658
Christie's	155	463.894	399.183	Pastel & Others	23	151.991	97.179
New York	228	467.600	405.063	Watercolor & Others	51	154.210	172.502
Other cities	25	420.181	240.933	Others	25	71.969	101.301
Signed	251	465.773	392.069	<b>Lot features</b>			
Dated	241	474.324	391.442	Sotheby's	100	104.379	115.792
Age artist work		48.82	16.95	Christie's	127	88.978	102.353
Surface in (cm)		5.827	7.909	New York	188	106.295	115.133
Surface in (cm) <sup>2</sup>		96.263.179	247.030.481	Other cities	39	44.991	39.882
Literature	104	720.538	408.640	Signed	226	95.007	108.143
Exhibition	85	582.853	405.989	Dated	219	96.824	109.206
Provenance	235	533.648	395.250	Age Botero's work (years)		52.13	14.00
Catalogue Raisonné	41	756.156	435.057	Surface in (cm)		1.842	4.189
Number of words		175.40	285.20	Surface in (cm) <sup>2</sup>		20.858.038	111.012.073
Number of words squared		111.781.75	257.165.27	Literature	44	174.860	147.177
Certificate of authenticity	43	415.379	372.105	Exhibition	52	122.712	128.258
Evening	188	509.738	406.149	Provenance	199	90.706	97.379
<b>Support</b>				<b>Support</b>			
Canvas	246	471.647	393.516	Number of words		16.02	95.70
Others	7	156.000	109.226	Number of words squared		20.858.038	111.012.073
<b>Topic</b>				<b>Topic</b>			
Nude	14	537.327	254.563	Certificate of authenticity	51	96.747	105.503
Other	17	366.893	370.179	Evening	109	123.107	127.570
People	96	606.317	476.154	<b>Support</b>			
portrait & self- portrait	31	476.157	266.374	Paper	155	66.382	69.820
Religion	34	340.082	224.399	Canvas	34	263.363	142.050
Still life	35	276.866	311.868	Others	38	66.945	57.698
Untitled	11	134.946	127.489	<b>Topic</b>			
Urban	15	521.199	329.726	Nude	11	49.925	35.685
				People	119	105.357	120.583
				Portrait	21	65.490	92.954
				Still life	40	97.966	102.676
				Other	36	93.265	91.725

## Sculptures

Variable	Number of Sculptures	Arithmetic mean (US\$)	Standard deviation (US\$)
<b>Price</b>	227	456.988	382.721
<b>Materials</b>			
bronze	118	491.392	421.573
bronze and dark brown patina	40	504.843	399.863
bronze and brown patina	29	400.922	301.782
bronze and others	16	313.875	195.641
Marble	18	432.006	322.538
others	6	188.917	133.223
<b>Lot features</b>			
Sotheby's	103	448.571	418.445
Christie's	124	463.980	351.885
New York	204	464.677	390.210
Other cities	23	398.463	320.319
Signed	225	458.148	384.144
Dated	183	462.281	399.710
Volume (cm <sup>3</sup> )		831.219	2.191.539
Volume squared (cm <sup>3</sup> ) <sup>2</sup>		5.472.611.648.501	22.506.153.416.161
Literature	106	467.642	377.698
Exhibition	48	471.059	466.684
Provenance	204	466.320	392.390
Single edition	21	396.029	320.635
Number of Editions	227	456.988	382.721
Total Editions	227	456.988	382.721
Artist proof	30	666.022	559.935
Number of words		74.33	177.94
Number of words squared		37.049	127.825
Certificate of authenticity	56	461.826	349.863
Evening	183	461.805	322.886
<b>Topic</b>			
Animals	41	367.515	201.943
Nude	105	477.604	393.955
Nude&animals	28	680.889	591.610
People	31	527.716	232.109
Others	22	140.714	79.517

Table 1 shows the descriptive statistics for paintings, drawings, and sculptures shown by color-related variables, technique (materials, in the case of sculptures), lot features, support (paintings and drawings), and topic. The average prices of paintings and sculptures were very close (\$462,914; and \$456,988, respectively), and were much higher than the average price of drawings (\$95,763). The sample includes all paintings, drawings and sculptures executed by Botero and sold at Sotheby's and Christie's between 2000 and 2020 (a total of 707 artworks, out of which 253 were paintings, 227 were drawings, and 227 were sculptures).

Source: Own calculations, christies.com and sothebys.com.

Table 2. Hedonic regression results for Botero's artistic expression's (2000-2020)

Dependent variable is LN(Pr)												
Variables	Coefficients			Standard errors			P > t			Price impact		
Color	Paint.	Draw.	Sculp.	Paint.	Draw.	Sculp.	Paint.	Draw.	Sculp.	Paint.	Draw.	Sculp.
<i>Red</i>	0.0012	-0.0043		0.0008	0.0015		0.1350	0.0040			-0.43%	
<i>Green</i>	0.0019	-0.0055		0.0010	0.0014		0.0600	0.0000		0.19%	-0.55%	
<i>Blue</i>	0.0028	-0.0054		0.0010	0.0011		0.0060	0.0000		0.28%	-0.54%	
<i>LAB:L</i>	0.0045	-0.0137		0.0024	0.0039		0.0650	0.0000		0.45%	-1.36%	
<i>LAB:A</i>	-0.0005	0.0383		0.0053	0.0092		0.9280	0.0000			3.90%	
<i>LAB:B</i>	-0.0038	0.0179		0.0026	0.0055		0.1400	0.0010			1.80%	
<i>Grayscale</i>	0.0019	-0.0054		0.0010	0.0014		0.0510	0.0000		0.19%	-0.53%	
<b>Technique</b>												
<i>Oil</i>	0.5028			0.1883			0.0080			65.3%		
<i>Graphite</i>		0.0673			0.1174			0.5670				
<i>Graphite &amp; Others</i>		-0.2022			0.1612			0.2110				
<i>Charcol &amp; Others</i>		0.3429			0.1592			0.0320			40.9%	
<i>Pastel &amp; Others</i>		0.4729			0.2169			0.0310			60.5%	
<i>Watercolor &amp; Others</i>		0.2984			0.1329			0.0260			34.8%	
<b>Materials</b>												
<i>Bronze</i>			0.4793			0.2456			0.0520			61.5%
<i>Bronze and dark brown patina</i>			0.4084			0.2461			0.0990			50.4%
<i>Bronze and brown patina</i>			0.6629			0.2394			0.0060			94.0%
<i>Bronze and others</i>			0.4682			0.2535			0.0660			59.7%
<i>Marble</i>			1.0612			0.3522			0.0030			189.0%
<i>Others</i>			0.0000			(omit.)						
<b>Lot features</b>												
<i>Sotheby's</i>	-0.1066	-0.0427	-0.0740	0.0668	0.0883	0.0642	0.1120	0.6290	0.2500			
<i>New York</i>	0.1415	0.0528	0.2007	0.1080	0.1165	0.1076	0.1910	0.6510	0.0640			22.2%
<i>Dated</i>	0.3074	0.2743	-0.0240	0.1322	0.2218	0.0699	0.0210	0.2180	0.7320	36.0%		
<i>Age artist work (LN)</i>	0.2581	0.5584		0.1283	0.1759		0.0450	0.0020		29.4%	74.8%	
<i>Area (cm<sup>2</sup>)</i>	0.0001	0.0002		0.0000	0.0001		0.0000	0.0000		0.0%	0.0%	
<i>Area squared (m<sup>2</sup>)<sup>2</sup></i>	0.0000	0.0000		0.0000	0.0000		0.0000	0.0020		0.0%	0.0%	
<i>Volume (cm<sup>3</sup>)</i>			0.0000			0.0000			0.0000			0.0%
<i>Volume squared (cm<sup>3</sup>)<sup>3</sup></i>			0.0000			0.0000			0.0000			0.0%
<i>Literature</i>	0.0528	0.1467	-0.0144	0.0196	0.1041	0.0172	0.0080	0.1600	0.4060	5.4%		
<i>Exhibition</i>	-0.0092	-0.0134	0.0196	0.0251	0.0342	0.0351	0.7140	0.6960	0.5760			
<i>Provenance</i>	0.0339	-0.0304	-0.0124	0.0368	0.0383	0.0301	0.3590	0.4280	0.6820			
<i>Catalogue Raisonné</i>	0.2397			0.1022			0.0200			27.1%		
<i>Number of editions</i>			0.0108			0.0186			0.5600			
<i>Total Editions</i>			-0.0572			0.0275			0.0390			-5.6%
<i>Single edition</i>			-0.5785			0.4203			0.1700			
<i>Artist's proof</i>			0.2639			0.1123			0.0200			30.2%
<i>Number of words</i>	0.0014	0.0004	0.0002	0.0003	0.0005	0.0002	0.0000	0.4310	0.4430	0.1%		
<i>Number of words squared</i>	0.0000			0.0000			0.0120			0.0%		
<i>Certificate of authenticity</i>	-0.0127	0.0756	0.0404	0.0766	0.0966	0.0658	0.8690	0.4350	0.5400			
<i>Evening</i>	0.2497	0.1249	0.1990	0.0887	0.1054	0.0858	0.0050	0.2370	0.0210	28.4%		22.0%
<b>Support</b>												
<i>Paper</i>		-0.4110			0.1798			0.0230				-33.7%
<i>Canvas</i>		0.0000			(omit.)							
<i>Others</i>		-0.4674			0.1884			0.0140				-37.3%
<b>Topic</b>												
<i>Nudes</i>	0.6968	-0.0011	0.8813	0.2571	0.2383	0.1010	0.0070	0.9960	0.0000	100.7%		141.4%
<i>Others</i>	0.1462	0.0547	0.0000	0.2495	0.1933	(omit.)	0.5590	0.7770				
<i>People</i>	0.8012	0.2278	1.1057	0.2321	0.1730	0.1074	0.0010	0.1900	0.0000	122.8%		202.1%
<i>Portrait and Selfportrait</i>	0.7839	0.0000		0.2398	(omit.)		0.0010			119.0%		
<i>Religion</i>	0.5442			0.2446			0.0270			72.3%		
<i>Still life</i>	0.3817	-0.0516		0.2362	0.1878		0.1080	0.7840				
<i>Untitled</i>	0.0000			(omit.)								
<i>Urban</i>	0.5674			0.2701			0.0370			76.4%		
<i>Animals</i>			0.8338			0.1089			0.0000			130.2%
<i>Nude and animals</i>			0.9613			0.1227			0.0000			161.5%
<b>cons</b>	8.768.079	8.391.574	1.0815	0.4653	0.6286	0.3772	0.0000	0.0000	0.0000			



**Table 2 (Cont.). Hedonic regression results for Fernando Botero's artistic expression's prices (2000-2020)**

<b>Variable / Artistic expression</b>	<b>Paint.</b>	<b>Draw.</b>	<b>Sculpt.</b>
<b>Number of observations (N)</b>	253	227	227
<b>Dependent variable</b>	LN Pr	LN Pr	LN Pr
<b>F (39, 212)</b>	0.00	0.00	0.00
<b>Probability &gt; F</b>	0.00	0.00	0.00
<b>R-square</b>	0.77	0.72	0.77
<b>Adjusted R-square</b>	0.72	0.66	0.72
<b>Mean square error root</b>	0.46	0.55	0.38

Source: Own calculations, Bloomberg.

Table 2 presents the results of the hedonic regression for each of Fernando Botero's artistic expressions (paintings, drawings, and sculptures). Values for paintings (coefficients, standard errors, P-values, and price impact) are presented in the columns in dark grey, values for drawings are shown in the columns in medium gray, and values for sculptures are presented in the columns in lighter gray. The dependent variable is the price (in logarithm) of each lot sold. The dependent variables are classified by: Color-dependent variables, technique, materials, lot features, support, and topic. The sample includes all paintings, drawings and sculptures executed by Botero and sold at Sotheby's and Christie's between 2000 and 2020 (a total of 707 artworks, out of which 253 were paintings, 227 were drawings, and 227 were sculptures).

**Table 3. Annual average return and standard deviation for Botero's artistic expressions, U.S. stocks and bonds (2000-2020)**

	<b>Average Return (%)</b>	<b>Standard Deviation (%)</b>	<b>Sharpe Ratio</b>
<b>Sculptures</b>	3.20	16.96	0.10
<b>Paintings</b>	3.36	26.00	0.07
<b>Drawings</b>	1.68	25.22	0.01
<b>S&amp;P500</b>	7.39	16.20	0.36
<b>US 10Y TB</b>	3.07	3.97	0.39
<b>US CPI</b>	2.13	1.07	0.56

Source: Own calculations, Bloomberg.

Table 3 shows that different artistic expressions can have a very different financial performance. Botero's paintings offered a return that was comparable to those of his sculptures (3.36% and 3.20%, respectively), but twice as high as those of his drawings (1.68%), being this last return statistically smaller (at the 5% level) to the previous two. In terms of risk, whereas his paintings and drawings had similar annual standard deviations of returns (26%, and 25.22%, respectively), his sculptures had a much smaller standard deviation (16.96%), being this last number statistically smaller (at the 1%) to the previous two. These results led sculptures to command the ranking in terms of Sharpe ratios (0.10), followed by paintings (0.07), and drawings (0.01). The sample includes all paintings, drawings and sculptures executed by Botero and sold at Sotheby's and Christie's between 2000 and 2020 (a total of 707 artworks, out of which 253 were paintings, 227 were drawings, and 227 were sculptures).

**Table 4. Return correlation matrix for Botero's artistic expressions (2000-2020)**

	<b>PAINTINGS</b>	<b>DRAWINGS</b>	<b>SCULPTURES</b>	<b>S&amp;P500</b>	<b>US 10Y TB</b>
<b>PAINTINGS</b>	1.00	0.69	0.13	-0.18	0.23
<b>DRAWINGS</b>	0.69	1.00	0.25	-0.01	0.41
<b>SCULPTURES</b>	0.13	0.25	1.00	0.71	0.77
<b>S&amp;P500</b>	-0.18	-0.01	0.71	1.00	0.84
<b>US 10Y TB</b>	0.23	0.41	0.77	0.84	1.00

Source: Own calculations, Bloomberg.

Table 4 shows the returns' correlation matrix for the assets considered. The correlations between Botero's sculptures (an artistic expression that is usually not considered when estimating the returns to art), and his paintings and drawings was very low (only 0.13 and 0.25). In turn, the correlation between his paintings and drawings were relatively higher (0.69). The correlations of his paintings and drawings with traditional assets were much lower, and even slightly negative. His sculptures had a relatively high correlation with the traditional assets considered (correlation of 0.71 with U.S. stocks and 0.77 with U.S. bonds). The sample includes all paintings, drawings and sculptures executed by Botero and sold at Sotheby's and Christie's between 2000 and 2020 (a total of 707 artworks, out of which 253 were paintings, 227 were drawings, and 227 were sculptures).

Figure 1. Price indexes for Botero's artistic expressions (2000-2020)

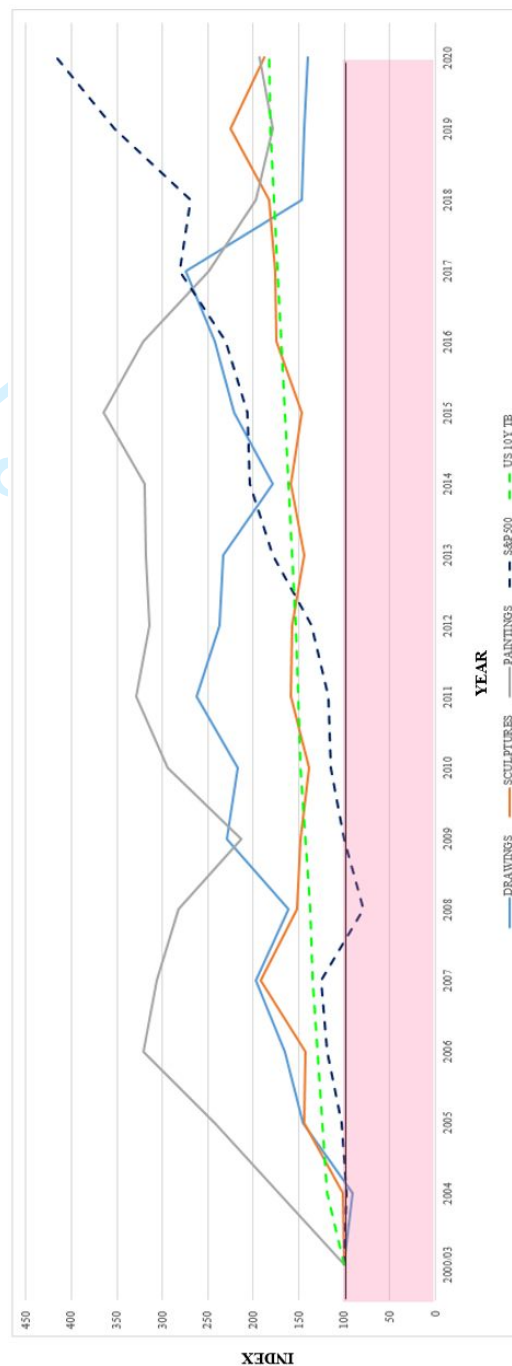


Figure 1 shows the evolution of the three art price indices, as well as those of U.S. stocks and bonds for the period considered. Sculptures exhibited a much lower standard deviation than paintings or drawings, and offered a return/risk relation that was comparable to that of U.S. bonds. The prices of paintings and drawings increase at a faster pace during the first half of the sample period, the stabilized and finally declined. In terms of returns, paintings and drawings were overperforming U.S. stocks until 2016. Following that year, stocks shut up, and paintings and drawings declined.