

# **Color Intensity, Luminosity and Contrast and Art Prices:**

## **The Case of Jean-Michel Basquiat**

### **ABSTRACT**

We analyze the impact of color and other variables that are intrinsic to artworks on the prices of paintings executed by Jean-Michel Basquiat, the famous Latino street artist from the 1980s' New York City art scene. We run a hedonic regression model considering 271 paintings executed by this artist and sold at Sotheby's and Christie's (2003-2017). We find that increases in color intensity and luminosity, as well as increases in color contrast, have a positive effect on the prices of his paintings. We estimate that Basquiat's artworks made collaboratively with Andy Warhol are worth 44% less than those made only by Basquiat (ours is the first paper to study the effects that paintings executed collaboratively by two artists may have on the prices of their works). An investment in the paintings of Basquiat generated an average annual compound return of 9.74% (2003-2017), slightly overperforming the S&P 500 total return index.

**aso**

**Keywords:** alternative investments, Basquiat, art returns, RGB, Lab, greyscale

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

September, 2019

# **Color Intensity, Luminosity and Contrast and Art Prices:**

## **The Case of Jean-Michel Basquiat**

### **INTRODUCTION**

Art has gained an increasing popularity as an alternative investment in recent decades. According to McAndrew (2019), 67.4 billion dollars' worth of art were exchanged in the global art market in 2018.

Most of the studies on the investment performance of art have been undertaken at the aggregate market level (see for instance, Campbell, 2008; Mei and Moses, 2012; Renneboog and Spaenjers, 2013). However, we still know relatively little about the determinants of prices of paintings at the individual artist level. Furthermore, the effect of color related variables on art prices has only recently been analyzed.

In this study we analyze the potential effect of color and other intrinsic variables as determinants of the prices of paintings at the artist level. To this end, we selected the artworks executed by Jean-Michel Basquiat, an artist belonging to the street art movement that sprang in New York City in the 1980s. The variety in a series of color related variables that characterize the paintings executed by Basquiat, offers a potentially rich background to analyze this question. Furthermore, we take advantage of the fact that Basquiat collaborated with Andy Warhol in creating a series of collective paintings between 1984 and 1985, and this allows us to measure whether this collaborative paintings are more or less expensive than Basquiat's own paintings, after controlling for a series of variables. To the best of our knowledge, we are the first to compare the prices of collaborative works to the prices of paintings executed by only one of the involved artists in the collaboration.

In this study we also construct a price index for the 2003-2017 period through a hedonic regression that considers a large number of variables that can influence the price of the works by Basquiat, with a particular focus on color-related variables.

The results obtained in this study allow us to identify a direct relationship between the intensity and contrast of the color of Basquiat's paintings and the expected performance of his paintings at auction. The study also identified that there are multiple variables that impact the value of a painting, such as: the area of the painting, the popularity of the painting (defined according to the number of previous owners, mentions in the art literature or number of previous exhibitions), and the city and the time at which the auction was carried out, among others.

## **LITERATURE REVIEW**

### **Art as an investment**

An increasing number of investors have incorporated alternative assets into their portfolios in the past two to three decades (see, among others, Korteweg, Kräussl and Verwijmeren, 2015). The art market has emerged as an alternative for the diversification of investment portfolios because the returns are relatively stable, even during adverse economic situations, such as recessions (Dimson and Spaenjers, 2014). However, the risk and return associated with investments in art is often poorly understood. This may explain, at least in part, why only 13% of wealth managers are willing to offer financial assets related to the art market to their clients (Deloitte, 2017).

The financial performance of art is usually determined using the information available from the auction market, with the Mei and Moses (MM) and Art Market Research (AMR) indices being among the most commonly used indicators. For example, using the AMR index, Campbell (2008) found that the art market provided a return of 6.56% for the period 1980-2006, which was lower than the returns provided by the S&P 500 (12.39%), the market of U.S. private debt (14.91%), the U.S. Government debt (8.36%) and the real estate market (11.98%) for the same period. However, art had the lowest standard deviation of all the investments considered; a finding that is consistent with the consideration of paintings as a "safe" asset. Furthermore, art is both a consumption and an investment good, and therefore, it should be expected to provide, on aggregate, lower returns than other traditional and alternative investments.

A feature of investing in art that increases its attractiveness is its low correlation with other market options (Mamarbachi, Day and Favato, 2008). However, transaction and maintenance costs are important in the art market. According to Renneboog and Spaenjers (2013), transaction costs can vary from 10% to 25% depending on the type of auction house and artist on sale. This means that art should be regarded as a long-term investment, even though long investment horizons for paintings entail higher maintenance costs in order to preserve their quality.

Although art is commercialized worldwide, the recorded sources of information about executed transactions are limited. The art market is formed by auction houses (being Sotheby's and Christie's the most well known), and retailers (mainly galleries, art fairs, and dealers). However, when analyzing the art returns, the only systematic and publicly available sales information is that released by auction houses.

From a methodological point of view, two methods are usually employed to determine the financial performance of the art market. The first is the Repeat Sales Regression (RSR) and consists of evaluating the evolution of the price of a specific painting after being sold at least two times. The main disadvantage of this method is the limited data that is available for works that have been auctioned on multiple occasions.

Another deficiency of the RSR is that the paintings that have appreciated in value are those more likely to be re-sold, which overestimates the yield obtained by generalizing the result for the entire market. For instance, Korteweg, Kräussl and Verwijmeren (2013), the annual return obtained for the standard RSR art index was on average 10% and a Sharpe ratio of 0.24 for the period 1972-2010. However, after correcting the data for the aforementioned upward bias, these authors obtained that the real return for the same period was 6.5% and the Sharpe ratio was equal to 0.04.

The second commonly used method is the Hedonic Pricing Method (Rosen, 1974); whereby an econometric regression is implemented to determine the price of a painting based on a set of characteristics or attributes that compose it. The regressions seek to link the price of a good or service based on a series of variables (some of them dichotomous or dummy variables) that are tied to the particularities of the good (in our case, of a painting).

The main limitation of this method lies in the need to have a significant and varied sample to identify the true effect of each variable on the price of the good.

According to Sotheby's, there are ten criteria that its specialists evaluate when determining the price of a painting for specific artists: authenticity, condition, scarcity, origin, historical importance, size, fashion, theme (image and color), medium used and quality (Sotheby's, 2016). All previously identified categories refer to the painting itself. The state of art market and the economy will also have an important effect on prices.

### **Studies of color as a hedonic variable in art pricing**

The price of a painting is determined by multiple hedonic variables, which will be described later in the paper. One of the intrinsic characteristics that affect the price of a painting is the composition of its color. The color palette selected in a painting has the capacity to generate an aesthetic stimulus which is able to define the perception of the audience through the emotions it generates in the viewers (Labrecque and Milne, 2011).

Each color perceived by the human eye can be defined using the RGB model. This model consists of the superposition of three beams of colors: red (R), green (G) and blue (B) at a single point. Digital images are composed of a vast number of small sets of information called "pixels". Each pixel has a defined color according to the intensity of the red, green and blue light beam that is added to it, based on a scale that ranges from 0 to 255. The closer that a pixel is to the point R0 G0 B0, the darker the image is, due to the absence of light. The opposite occurs when one observes: R255 G255 B255, which is represented by the white color.

It is possible to study the RGB model as a three-dimensional space defined by vectors with three coordinates. In this vision, each pixel is expressed as a vector of red, green and blue colors, stored in an 8-bit matrix (Pownall and Graddy, 2016). This vector system allows one to define the intensity level of the color. High intensity colors look more vivid.

As the hue or intensity there are other additional attributes that define the color by modifying its RGB vector: saturation, brightness and contrast. Saturation refers to the level of pigmentation that a color presents. As saturation increases, color is identified as purer. A color with low saturation is usually seen as grayish, while one with high saturation is distinguished as vivid, as it is in its purest state (Labrecque and Milne, 2011).

Alternatively, there are other models such as the Lab color space. Similar to the RGB model, in the Lab color space each color is defined in a three-dimensional space (three coordinates). The first plane (L) represents the brightness of the color, the second plane (a) and the third plane (b) identify where the color is located within a chromatic space defined by the red-green and blue-yellow colors, respectively (Deng, Hui, and Hutchinson, 2010). Luminosity is defined as the level of clarity or darkness present in a color. This feature is visually distinguished based on the closeness of the color to the opposite black-white binomial.

Finally, the grayscale method eliminates hue and saturation from an image and is used to determine the luminosity of a color. As a result, the use of the grayscale method allows one to obtain a given value within the existing linear spectrum between the white color (R255, G255, B255) and black (R0, G0, B0). The greater the grayscale value obtained, the greater the luminosity of the color (Pownall and Graddy, 2016).

Additionally, another variable that impacts the study of color in the return of artworks is color contrast. Contrast refers to the interaction between two or more colors within an image, increasing as the colors are more distant from each other in the color palette.

Only a few studies on the determinants of art prices have focused on the potential effect of the color palette. Most studies have focused mainly on measuring the effects of other variables, such as authenticity (through the artist's signature), size and medium.

Stepanova (2015) implements hedonic regressions to the works of Pablo Picasso using the color palette as a variable, defined through the model of RGB colors for pixels, and finds that an increase in one thousand square centimeters of blue color was associated with an increase of 19.2% in the value of the painting. The same area increase, but in orange, represented an increase of 41.2% in the price. Stepanova (2015) also determined

that paintings composed of a palette of contrasting colors are usually sold at higher prices in public auctions, estimating that for each 1% increase in the Euclidean distance within the composition of colors (defined by the space of the RGB model), it is obtained an increase of 0.34% in the price of the work.

Similarly, Pownall and Graddy (2016) performed hedonic regressions to a sample of serigraphs sold by Andy Warhol in 2012, trying to define the valuation of works based on the intensity and luminosity of the color. The authors obtained that a decrease of 1% of the average RGB for each work represented an increase of 0.3 to 0.4% in its price, and that for each percentage unit of reduction in the luminosity level, an increase of 0.4% in the price of the work is observed. While Pownall and Grady (2016) found that color intensity and lightness affected art prices, the use of only one year of observations (2012) and one medium (178 serigraphs sold), which is not the usual means of artistic expression used by artists, raises the question as to whether these findings would hold on a sample containing paintings (as opposed to serigraphs) and a larger time period.

Finally, Garay and Pérez (2019) analyze the impact of a series of color related variables on art prices for the case of the “Big-5” artists from the Latin American art market (Fernando Botero, Wilfredo Lam, Roberto Matta, Diego Rivera and Rufino Tamayo). They find that color intensity, lightness and luminosity is a crucial part of a pricing model for these artists.

The aim of this study is to evaluate the importance of color-related variables, controlling for another set of attributes (*e.g.*, size of the work, technique used, etc.), on the prices of paintings executed by New York City’s urban artist Jean-Michel Basquiat. In addition, we intend to determine the risk and return of having invested in works by this artist, and to evaluate whether the paintings executed collaboratively between Basquiat and Warhol differ in price to those painted only by Basquiat.

Jean-Michel Basquiat was born in New York City in 1960. His father was from Haiti and his mother was born to Puerto Rican parents.<sup>1</sup> Art critics argue that Basquiat's

---

<sup>1</sup> According to Artsy: “Basquiat is almost exclusively referred to as a black American artist, although his father, Gérard Basquiat, was born in Port-au-Prince, Haiti, and his mother, Matilda Andrades, was born of Puerto Rican parents. The positioning of Basquiat’s identity as exclusively black highlights the ongoing invisibility of Latinx artists in the U.S. art market, a result of a historic lack of private patronage,

diverse cultural heritage was an important source of his inspiration. His emergence came from the "punk" scene in New York City as a graffiti and street artist. In a few years, Basquiat quickly rose to become one of the most famous American artists and, one of the most important in the contemporary market. He used Spanish text and integrate Latino culture into many of his works. Basquiat died in 1988, when he was only 28 years old.

According to experts in contemporary art, Basquiat's most important paintings were executed in 1982. In fact, his three most expensive works at auction to date were made in that year: *Untitled*, sold for \$110.5 million in 2017 (see Exhibit 1, which also shows the computed values for RGB and Lab for this painting); *Untitled*, sold for \$57.28 million in 2016, and *Dustheads*, sold for \$48.84 million in 2013 (Gotthardt, 2018).



*Exhibit 1. "Untitled" (1982) by Jean-Michel Basquiat, sold for a record for the artist of \$110.5 million (including buyers premium) at Sotheby's-New York City, May, 2017. Taken from Sothebys.com*

---

underexposure, and widespread confusion about what constitutes Latinx art, as opposed to Latin American art. The term "Latinx" (pronounced /la-teen-ex/) is the gender-neutral alternative to Latino, Latina, and Latin@, and refers to numerous intersecting identities of Latin American and Caribbean descendants born or long living in the U.S." (<https://www.artsy.net/article/artsy-editorial-americas-expensive-artist-latinx-one>).

For this painting: R = 89, G = 119, B = 129, L = 49, a = -2, b = -7

## DATA AND METHODOLOGY

### Data

We collected information related to paintings executed by Jean-Michel Basquiat and sold at auction on Christie's and Sotheby's during the period 2003-2017. We search the webpages of these two auction houses and complemented some of the information (such as missing digital images of the paintings) using the Blouin Art Sales database.

In order to provide more information to potential buyers, the auction houses offer detailed information on the works to be auctioned, including: date of completion, dimensions, technique, previous owners, among others. In total, 271 paintings executed by Basquiat were sold during that period.<sup>2</sup>

### Methodology

Following the literature (e.g., Worthington and Higgs, 2005, Campbell, 2008; Campos and Barbosa, 2009; Kraeussl and Logher, 2010; Taylor and Coleman, 2011; Renneboog and Spaenjers, 2013; Stepanova, 2015; Vosilov, 2015; Pownall and Graddy, 2016; and Garay, 2019), the hedonic model will be estimated by running an Ordinary Least Squares Regression (OLS). The OLS is fixed effects with respect to both time and cross-sections. It is important to note that individual effects are not present here because the  $i$ -th painting auctioned at time  $t$  is not necessarily (and most likely will not be, considering the very few repeat sales usually present in the data in this type of studies) the same as the  $i$ -th painting sold at time  $t'$ , where  $t' \neq t$ . The dependent and independent variables of the model are described as follows:

---

<sup>2</sup> We did not include “buy-ins” in our database. These are lots that were announced for sale at auction but could not be sold because their prices did not reach the reserve price, or the minimum acceptable price set by the seller.

### Dependent variable

- Auction sale price (including commission - expressed in Neperian logarithm): represents the dependent variable of the study. Following the literature, we expressed the dependent variable in logarithms to reduce very wide dispersions.

We classified the characteristics of each painting sold into three groups, depending on the element to which they are intrinsic: variables intrinsic to color, variables intrinsic to the work, and variables intrinsic to the auction.

### Variables intrinsic to color

- Color intensity and luminosity: using the digital images of the auctioned works and special software, we computed the RGB (intensity) and LAB (luminosity) scale for each pixel and for each painting.
- Color contrast: Defined as the existing difference of intensity. It is computed as the difference between the maximum and the minimum value for each of the registered color intensity variables (RGB and LAB) present in a pixel in the respective digital image.
- Grayscale: using the results obtained from the color of each artwork, two grayscale values are calculated (one for intensity/luminosity and the other for contrast). The grayscale is determined using the following formula:

$$0.2989 \times \text{RED} + 0.587 \times \text{GREEN} + 0.114 \times \text{BLUE}$$

### Variables intrinsic to the painting

- Area: measured in square inches, reflects the physical area of each painting based on its dimensions (height x length).

- Square area: measurements in square inches squared (in<sup>4</sup>). This variable allows one to study the variation in price per each additional unit of area (it defines the concavity or convexity of the value of the work as the area increases).
- Technique: the works were classified according to the technique used for their creation (oil, acrylic, oil and acrylic, and others). This is a dummy variable.
- Support: the works were grouped based on the support used by Basquiat (canvas, wood, panel, and others). This is a dummy variable.
- Signature: whether the painting had the original signature of Basquiat or not. This is a dummy variable that takes the value of 1 if the painting is signed and 0 otherwise.
- Age of the artist (expressed in Neperian logarithm): reflects the age of the artist at the time of completing the painting.
- Authenticity: whether the painting is accompanied by a certificate of authenticity, either from the artist, his respective foundation or from a third party. This is a dummy variable that takes the value of 1 if the painting has certificate of authenticity, and 0 otherwise.
- *Provenance*: studies the number of previous owners who had a specific painting before being sold at auction. Three classifications were made: works with less than two previous owners, works with three to four previous owners, and works with five or more previous owners. This is a dummy variable.
- Exhibition: defines the number of times that a painting had been exhibited in museums and galleries before being sold at auction. Three classifications were made: works without previous exhibitions, paintings with one to two previous exhibitions, and works with three or more previous exhibitions. This is a dummy variable.
- Literature: details the number of art publications (books, catalogs) in which the work had been referenced before being sold at auction. Three classifications were made: works without mentions in the literature, paintings with one to two mentions in literature, and works with three or more mentions in the literature. This is a dummy variable.
- Catalog note: variable that defines the total number of words used to describe the lot in the auction catalog note of the work.

- Warhol: dummy variable that specifies whether the work was done collaboratively between Basquiat and Warhol, in which case the variable takes the value of 1, and 0 otherwise.

#### Variables intrinsic to the auction

- Auction house: specifies if the work was auctioned at Sotheby's (dummy variable equal to 1) or at Christie's (dummy variable equal to 0).
- Evening auction: The main auctions are usually held in the evening (dummy variable equal to 1), while secondary auctions occur in the morning (dummy variable equal to 0).
- City of the auction: defines in which city the auction took place: New York City, London or others (Paris, Hong Kong and Shanghai).
- Year of the auction: studies the effect of the year on the price of the auction, starting in 2003 and ending in 2017. A dummy variable takes the value of 1 in each year in which paintings are sold.

We constructed a table of hedonic variables, transforming the qualitative variables into dummy variables, and referenced the presence of the characteristic with the value "1" and its absence with the value "0".

#### **Hedonic regressions**

A total of fourteen regressions were run, whereby a different color variable specification was used in each of them, as one would expect collinearity among them (Pownall and Grady, 2016): RGB red (R), RGB green (G), RGB blue (B), luminosity (L), color space A, color space B and grayscale. The first seven of these regressions measure the effect of color related variables on the prices of paintings by Basquiat (Exhibit 4), while the remaining seven regressions measure the effect of color contrast on the prices of his artworks (Exhibit 5).

Whenever a result obtained in a regression is significant, the respective coefficient is used to determine the price impact of the respective variable. In the hedonic price model, this impact is quantified using the following formula ( $r$  = price impact,  $c$  = estimated coefficient of the variable):

$$r = e^c - 1$$

Finally, using the coefficient obtained for the variable "Year of the Auction", we constructed an annual index to analyze the performance of Basquiat's artworks and its evolution over time. The annual index is calculated by applying the following formula ( $i_{year}$  = annual index,  $c_{year}$  = coefficient of the variable for each auction year):

$$i_{year} = 100 \times e^{c_{year}}$$

Exhibit 2 shows descriptive statistics of the data, reflecting the average level of color intensity and contrast, standard deviations, and minimum and maximum values for each of the color variables studied. One can observe a relatively large dispersion for each of the color related variables.

Variable	Jean-Michel Basquiat				
	Number of paintings	Arithmetic Mean	Standard Deviation	Minimum	Maximum
<b>Price</b>	271	\$4.932.304	\$9.660.699	\$32.200	\$110.487.500
<b>Color related variables</b>					
<b>Red</b>	-	155,49	47,65	30	241
<b>Green</b>	-	144,77	43,33	22	240
<b>Blue</b>	-	127,91	44,56	18	236
<b>Luminosity (L)</b>	-	60,23	16,42	9	95
<b>A</b>	-	3,37	8,38	-25	36
<b>B</b>	-	10,79	14,21	-33	69
<b>Grayscale</b>	-	146,04	42,18	23,93	239,82
<b>Color contrast variables</b>					
<b>Red</b>	-	221,27	25,77	122	255
<b>Green</b>	-	214,07	22,91	108	253
<b>Blue</b>	-	213,90	26,19	80	255
<b>Luminosity (L)</b>	-	83,13	10,81	42	99
<b>A</b>	-	65,56	25,86	2	124
<b>B</b>	-	83,18	29,57	3	135
<b>Grayscale</b>	-	216,18	21,85	108,98	251,95

Exhibit 2 – Color related variables and color contrast variables for Jean-Michel Basquiat (271 artworks)

*Source: Own calculations made from Sotheby's and Christie's websites*

Exhibit 3 shows the other descriptive statistics of the date. Regarding technique (medium) one can see that, in general, paintings that use both oil and acrylic as a medium tend to be more valuable compared to those that only use oil, acrylic or other.

Regarding the support of the painting, Basquiat's paintings executed on non-conventional media (wood) are the most expensive, followed by panel, canvas and others.

Paintings sold at Christie's were more expensive than those sold at Sotheby's. Works of art sold at the auctions held in New York City and in the evening, commanded a higher price than those sold in any other city or at daytime auctions.

Regarding the intrinsic characteristics of the work, we found that: 65% of the paintings are signed, the average number of previous owners is 2.65, the average number of exhibitions is 2.11, and the average number of references in the literature is 2.32. The average number of words used to describe a Basquiat lot in auction catalogs is 813.54. It is noteworthy that the paintings that Basquiat executed collectively with Andy Warhol are 44% cheaper than those executed only by Basquiat. It is also observed that Basquiat's signed works are not more expensive than those that were not signed.

Variable	Jean-Michel Basquiat				
	Number of paintings	Arithmetic Mean	Standard Deviation	Minimum	Maximum
<b>Technique and support</b>					
Oil	8	\$2.266.565	\$2.916.057	\$321.600	\$8.961.482
Acrylic	54	\$2.875.477	\$7.761.043	\$32.200	\$57.285.000
Oil and Acrylic	203	\$5.703.471	\$10.302.174	\$32.500	\$110.487.500
Others	6	\$906.901	\$945.790	\$32.500	\$2.440.214
Canvas	223	\$4.895.792	\$9.929.989	\$32.200	\$110.487.500
Wood	17	\$7.882.789	\$11.479.819	\$321.600	\$34.967.500
Panel	13	\$5.183.062	\$7.899.806	\$341.000	\$28.223.876
Others	18	\$2.416.973	\$3.326.935	\$78.720	\$13.522.500
<b>Characteristics of the auction</b>					
Christie's	115	\$5.624.114	\$9.863.963	\$32.200	\$57.285.000
Sotheby's	156	\$4.422.315	\$9.507.654	\$32.500	\$110.487.500
New York	154	\$5.622.118	\$12.134.289	\$32.200	\$110.487.500
London	98	\$4.134.515	\$4.780.380	\$78.720	\$28.223.876
Others	19	\$3.456.093	\$3.924.878	\$354.756	\$17.686.339
Evening	215	\$5.983.727	\$10.588.865	\$32.200	\$110.487.500
<b>Characteristics of the lots</b>					
Signed	177	\$5.023.879	\$10.745.401	\$32.200	\$110.487.500
Area (Inches <sup>2</sup> )	-	5025,92	3.645,48	23,50	28.188,00
Age	-	23,42	1,75	20	28
Number of references in literature	-	2,32	2,32	0	11
Number of exhibitions	-	2,11	2,64	0	15
Provenance (number of owners)	-	2,65	1,44	0	9
Number of words	-	813,54	608,00	0	3.149
Certificate of Authenticity	37	\$2.921.155	\$6.191.457	\$32.500	\$37.125.000
Andy Warhol	33	\$1.250.244	\$1.152.645	\$32.500	\$5.675.643

*Exhibit 3 – Descriptive statistics for the prices of paintings of Basquiat  
Source: Own calculations made from Sotheby's and Christie's websites*

Exhibit 4 shows the results obtained for the seven regressions ran to the 271 works of Jean-Michel Basquiat (for ease of presentation, in the case of control variables, only statistically significant coefficients are shown). The R squares are around 80%, indicating a very good fit of the data.

Jean-Michel Basquiat (n = 271)

Dependent variable is Log price

Variable		PANEL A			PANEL B		PANEL C	
		Red	Green	Blue	L	a	b	Grayscale
<b>Color related variable</b>		-0.0016* 0.0009	-0.0024** 0.0011	-0.0024** 0.0010	-0.0054* 0.0028	0.0086* 0.0051	0.0019 0.0023	-0.0024** 0.0011
<b>Year Dummies</b>		Included						
<b>Characteristics of the lots</b>	<b>Area (inch<sup>2</sup>)</b>	0.0002*** 0.00003						
	<b>Area squared (inch<sup>4</sup>)</b>	-7.55E-09*** 1.35E-09	-7.49E-09*** 1.35E-09	-7.36E-09*** 1.33E-09	-7.48E-09*** 1.34E-09	-7.65E-09*** 1.38E-09	-7.58E-09*** 1.36E-09	-7.48E-09*** 1.34E-09
	<b>Sotheby's</b>	0.2317** 0.0928	0.2206** 0.0933	0.2130** 0.0941	0.2219** 0.0939	0.2516*** 0.0922	0.2466*** 0.0924	0.2202** 0.0934
	<b>Evening</b>	0.6543*** 0.1233	0.6476*** 0.1227	0.6355*** 0.1236	0.6473*** 0.1239	0.6786*** 0.1191	0.6635*** 0.1194	0.6460*** 0.1234
<b>(Literature = 0 was omitted)</b>	<b>Literature = 1-2</b>	0.2209 0.1350	0.2402* 0.1338	0.2468* 0.1331	0.2336* 0.1340	0.2941** 0.1420	0.2626* 0.1359	0.2300* 0.1336
<b>(London was omitted)</b>	<b>New York City</b>	0.2397** 0.0975	0.2298** 0.0984	0.2151** 0.0991	0.2323** 0.0984	0.2499** 0.0976	0.2448** 0.0975	0.2293** 0.0983
	<b>Other cities</b>	-0.3183 0.2009	-0.3199 0.2005	-0.3232 0.2007	-0.3197 0.2008	-0.3507* 0.2015	-0.3406* 0.2020	-0.3167 0.2005
	<b>Number of words</b>	0.0008*** 0.0001	0.0008*** 0.0001	0.0008*** 0.0001	0.0008*** 0.0001	0.0009*** 0.0001	0.0009*** 0.0001	0.0008*** 0.0001
	<b>Warhol</b>	-0.5652*** 0.1545	-0.5567*** 0.1538	-0.5663*** 0.1526	-0.5597*** 0.1541	-0.5083*** 0.1557	-0.5474*** 0.1531	-0.5636*** 0.1539
	<b>Log age</b>	-1.6469** 0.6772	-1.5388** 0.6687	-1.4456** 0.6716	-1.5468** 0.6718	-1.3624** 0.6659	-1.4208** 0.6712	-1.5877** 0.6711
	<b>Constant (Intercept)</b>	16.6587***	16.5883***	16.2261***	16.6179***	15.4800***	15.6812***	16.6926***
<b>R-squared</b>		0.7986	0.8009	0.8013	0.7997	0.7985	0.7965	0.8007

\*\*\*, \*\*, and \* denote statistical significance at 1%, 5%, and 10%, respectively

Note: For ease of presentation, in the case of control variables only statistically significant coefficients are shown

#### Exhibit 4 – Color related variables-Regression results for Basquiat

##### A.1. Color related variables

Exhibit 4 shows that the variables Red, Green, Blue, Luminosity, Color Space A and grayscale are significant in their respective regressions. Regarding the three RGB variables, a negative impact is found. This means that the more intense the color of the painting is (as one moves from 255 to 0 in each of the *R*, *G*, and *B* variables), the higher the price. Results are significant at the 5% to 10% levels.

When evaluating each color individually, one observes a greater impact for the blue and green colors (0.24% for each additional level of color intensity) in relation to the red color (0.16% for each additional level). In other words, an individual intensity increase of blue or green colors will have a greater price impact than an individual increase in the red color. This analysis should not be confused with the variation of the color palette within the work, which is analyzed with the Lab space. The RGB intensity analysis exclusively studies the variation of the intensity of each color without changing the current palette of the painting.

At the luminosity level ( $L$ ), the study also shows a negative relation, meaning that prices increase 0.54% for each additional level of luminosity (brightness). This result is consistent with the previous analysis that determines higher artworks returns at a higher intensity of color: as the colors are less bright (darker) they will be relatively more intense.

Within the A/B color space only the color space  $a$  was significant for the regression (at the 10% level). The color space  $a$  was designed to vary from negative values (green) to positive values (magenta). Particularly for the works of Basquiat, as the level of magenta color used is increased by one unit (thus reducing the green color) the work will gain 0.86% in value for each unit increase. Therefore, it can be stated that red/magenta colors generate greater value for Basquiat's works in relation to the green color.

Finally, the variable grayscale behaves analogous to the luminosity variable, yielding a negative relation, meaning that the prices of paintings increase 0.24% for each unit increase in blackness in the grayscale (5% level of significance). Similar to the luminosity, the grayscale scale used ranges from 0 (completely black) to 255 (completely white).

## A.2. Control variables

### Area and Area squared

The variables Area and Area squared were both significant. Each square inch increase in the area of a painting is associated with an increase of 0.020% in the price of the work. However, prices of paintings increase at a decreasing rate when area increases. This concavity effect is reflected by the Area squared variable, whose coefficient on the regression is negative. This result is consistent with the literature (see, among others, Renneboog and Spaenjers, 2013; Stepanova, 2015; Pownall and Grady, 2016; and Garay, 2019).

### Technique and support

None of these variables were significant. In the case of technique, this might seem surprising. However, the fact that oil and acrylic have been found to command high prices

in previous research (Renneboog and Spaenjers, 2013; Garay, 2019), and also that almost all of the paintings by Basquiat were executed using these techniques or a mixture of the two help explain this result.

#### Provenance, number of exhibitions and mentions in literature

The variables number of previous exhibitions was not significant (Stepanova, 2015 also found that these variables were not significant in her study). On the other hand, the variable art literature was significant (this result is consistent with Stepanova, 2015). Works that received one or two mentions in the literature increased about 25% in value compared to works that were not mentioned.

#### Auction house, city, auction moment and number of words in the catalog note

Paintings by Basquiat sold at Sotheby's are worth more than those sold at Christie's. This is a somewhat surprising result since many research studies conclude that prices of paintings are statistically the same in both auction houses.

Furthermore, results suggest that paintings command higher prices when the auction is held: in New York City (27% more expensive than in London) and in the evening (90% more than if the work is auctioned during the morning event). The result regarding the evening auction is consistent with Stepanova (2015). The evening auction is reserved for the best lots by auction houses.

Finally, paintings appreciate 0.08% for each additional word that is used in the lot description or catalog note included in the web page of each auction house.

#### Age of the artist

Earlier paintings by Basquiat tend to be more expensive. The paintings in the sample were executed between 1980 and 1988. This may well be explained by the fact that, in his earlier years, he did not have a contractual pressure to execute a certain number of paintings within a rigid chronogram, something that would happen later in his artistic

career, and which would affect the quality of his paintings (Gottard, 2018). Pownall and Grady (2016) found a similar result when they studied the serigraphs produced by Warhol.

### Andy Warhol

Another interesting result was that works of Basquiat made in conjunction with Andy Warhol are, on average, worth 44% less than the artworks made only by Basquiat, once one controls for all the other variables. This is, to the best of our knowledge, the first study that reports the effect on prices of having a painting executed collaboratively between two artists. And the effect, marketwise, is very negative in this case.

### B. Color contrast

The following color contrast variables were significant: Red (RGB), the A/B space, and grayscale (Exhibit 5). The result for the contrast variable for Space A indicates that an increase in value of 0.82% as the contrast between the magenta and green colors of the work, *ceteris paribus*, increase by one unit. Analogously, the result of the contrast variable for Space B reflects a value increase of 0.90% as the contrast between the blue and yellow colors increases by one unit.

Finally, Exhibit 6 shows the evolution of the price index for Basquiat 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 hedonic regression, performing the calculation  $e^{Y_t}$  for each of the estimated coefficients  $Y_t$ . It can be observed that the prices of Basquiat's works increased substantially between 2003 and 2007 (a 180% increase) and then, suffered a considerable drop in 2008 and 2009, in the context of the Global Financial Crisis. Prices recovered from 2010 to 2017, making new highs on that year. In the period studied, the average annual compounded return provided by Basquiat's paintings was 9.74%, versus 8.79% for the S&P 500 (total return) during the same period.

**Jean-Michel Basquiat (n = 271)**

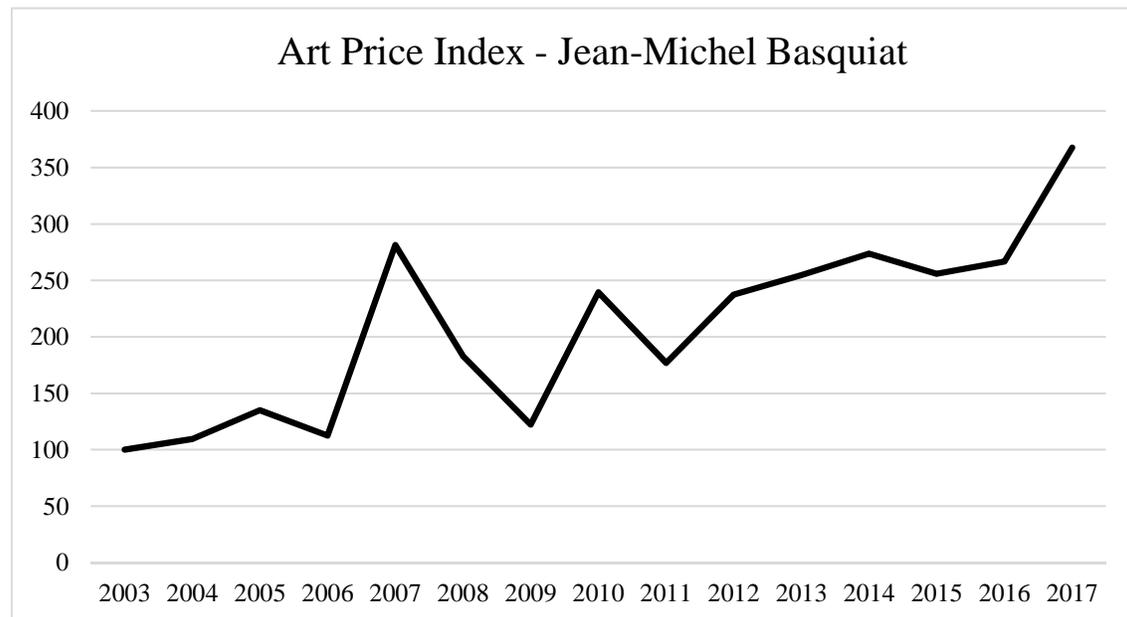
Dependent variable is Log price

Variable		PANEL A			PANEL B		PANEL C	
		Red	Green	Blue	L	a	b	Grayscale
Color contrast variable		0.0033* 0.0017	0.0028 0.0019	0.0028 0.0017	0.0019 0.0040	0.0082*** 0.0015	0.0090*** 0.0014	0.0037* 0.0020
Year Dummies		Included						
Characteristics of the lots	Area (inch <sup>2</sup> )	0.0002*** 0.00003						
	Area squared (inch <sup>4</sup> )	-7.45E-09*** 1.34E-09	-7.49E-09*** 1.30E-09	-7.46E-09*** 1.29E-09	-7.59E-09*** 1.35E-09	-7.71E-09*** 1.39E-09	-5.99E-09*** 1.16E-09	-7.44E-09*** 1.30E-09
	Sotheby's	0.2659*** 0.0914	0.2415*** 0.0924	0.2247** 0.0932	0.2468*** 0.0924	0.3134*** 0.0862	0.1805** 0.0897	0.2452*** 0.0919
	Evening	0.6546*** 0.1189	0.6418*** 0.1191	0.6452*** 0.1180	0.6575*** 0.1222	0.6394*** 0.1138	0.5763*** 0.1118	0.6396*** 0.1184
(Literature = 0 was omitted)	Literature = 1-2	0.2273* 0.1357	0.2438* 0.1363	0.2490* 0.1388	0.2476* 0.1374	0.2991** 0.1318	0.2163* 0.1247	0.2363* 0.1363
(London was omitted)	New York City	0.2795*** 0.1005	0.2719*** 0.0983	0.2807*** 0.0992	0.2568*** 0.0989	0.2757*** 0.0971	0.2711*** 0.0913	0.2815*** 0.0996
	Other cities	-0.3336* 0.1978	-0.3440* 0.1971	-0.3224 0.1967	-0.3400* 0.2016	-0.2910 0.1877	-0.2308 0.1786	-0.3388* 0.1961
	Number of words	0.0008*** 0.0001	0.0009*** 0.0001	0.0009*** 0.0001	0.0009*** 0.0001	0.0008*** 0.0001	0.0008*** 0.0001	0.0009*** 0.0001
	Warhol	-0.5805*** 0.1502	-0.5777*** 0.1535	-0.5651*** 0.1536	-0.5566*** 0.1562	-0.6441*** 0.1405	-0.5836*** 0.1416	-0.5854*** 0.1518
	Log age	-1.6299** 0.6754	-1.5492** 0.6680	-1.5247** 0.6650	-1.4876** 0.6696	-2.0548*** 0.6336	-1.9597*** 0.6140	-1.5931** 0.6692
	Constant (Intercept)	15.6398***	15.5718***	15.4910***	15.7649***	17.2539***	16.9937***	15.4745***
R-squared		0.7991	0.7979	0.7983	0.7963	0.8145	0.8245	0.7988

\*\*\*, \*\*, and \* denote statistical significance at 1%, 5%, and 10%, respectively

Note: For ease of presentation, in the case of control variables only statistically significant coefficients are shown

*Exhibit 5 – Color-contrast-variables-Regression results for Basquiat*



*Exhibit 6 – Evolution of Jean-Michel Basquiat's Art Price Index (2003 = \$100)*

Source: Own calculations based on information obtained from Christie's and Sotheby's website

## CONCLUSIONS AND RECOMMENDATIONS

We found strong evidence indicating that color analysis (intensity, luminosity and contrast) is an essential component in the pricing of paintings for particular artists. More specifically, we list here the following main conclusions regarding the pricing of Basquiat's paintings, *ceteris-paribus*:

- Increases in color intensity and luminosity, and color contrast, have a positive and significant impact on the prices of his paintings. More specifically, a one point increase in the color intensity level for the blue and green colors is associated with a 0.24% increase in the price of a painting. In the case of the red color the increase is 0.16%. A one point increase in luminosity is associated with a 0.54% increase in the price of a painting.
- Red/magenta colors generate greater value for Basquiat's works in relation to the green color.
- Paintings reach higher prices when they are sold in New York City compared to London or other cities.
- Paintings sold in the evening are more expensive than those sold during the morning auctions.
- The works sold at Sotheby's have higher prices than those auctioned at Christie's.
- The larger the number of words used in the catalog note to comment on the respective lot, the greater the price achieved by the painting.
- Paintings executed earlier in Basquiat's life are more expensive.
- Paintings command higher prices at a decreasing rate as the area increases.
- Paintings executed using oil and acrylic tend to be more expensive.
- Basquiat's artworks made jointly with Andy Warhol are worth 44% less than those made only by Basquiat.
- The works of Jean-Michel Basquiat generated an average annual return of 9.74% between 2003 and 2017, slightly overperforming the Standard and Poor's

500, and confirming the boom that this artist has experienced during the past fifteen years.

When one compares the present study with previous research, such as Stepanova (2015), Pownall and Graddy (2016), and Garay and Pérez (2019), it can be appreciated that, in effect, increases in color intensity and color contrast have positive impacts on the expected performances of Basquiat's artworks. In the case of Basquiat these effects are particularly noticeable, as well as the importance of color contrast on the prices of his paintings.

Also, and very importantly, Basquiat's paintings executed with Andy Warhol are worth 44% less than those made only by Basquiat. This is, to the best of our knowledge, the first paper that documents the effect of executing works in collaboration on the prices of an artist's paintings. We will try to determine, in future research, the potential reasons that might explain this, for the case of the collaborative works of Basquiat and Warhol.

There are funds that are currently using quantitative tools in the art market to ascertain the effect of color as one of the variables that can explain the prices of individual works of art. For example, Arthena, an art fund, applies quantitative investing tools that are similar to those employed by quantitatively driven funds that base their decisions on algorithms and machine-learning processes, finding that certain colors from specific artists do better than others (see the report by Melendez, 2017). Our paper has shed important findings regarding this issues.

## References

- Campbell, R (2008): "Art as a Financial Investment", *The Journal of Alternative Investments*, Spring 2008, 10 (4) 64-81.
- Campos, N. and R. Barbosa (2009): "Paintings and Numbers: An Econometric Investigation of Sales Rates, Prices, and Returns in Latin American Art Auctions", *Oxford Economic Papers*, 61, 1, 28-51.
- Deloitte. (2017). "Art & Finance Report 2017: 5<sup>th</sup> Edition", Deloitte Luxembourg.
- Deng, X., Hui, S.K., & Hutchinson, J.W. (2010): "Consumer preferences for color

- combinations : An empirical analysis of similarity-based color relationships”, *Journal of Consumer Psychology*, 20(4), 476-484.
- Dimson, E., and Spaenjers, C. (2014): “The investment performance of art and other collectibles”, Chapter 10 in Anna Dempster (Ed), *Risk and Uncertainty in the Art World*, Bloomsbury Publishing, 2014, 219–238.
- Garay, U. (2019): “Determinants of art prices and performance by movements: Long-run evidence from an emerging market”, *The Journal of Business Research* (forthcoming).
- Garay, U. and E. Pérez (2019): “The Impact of Color on Art Prices: An Examination of Latin American Art”, unpublished manuscript.
- Gotthardt, Alexxa (2018): “What Makes 1982 Basquiat’s Most Valuable Year”, Artsy <https://www.artsy.net/article/artsy-editorial-1982-basquiats-valuable-year>, May.
- Korteweg, A, Kräussl, R, Verwijmeren, P. (2015): “Does it Pay to Invest in Art? A Selection-corrected Returns Perspective”, *Review of Financial Studies*, Volume 29, No. 4.
- Labrecque, L, Milne, G. (2011): “Exciting red and competent blue: the importance of color in marketing”, Miami: Academy of Marketing Science, Miami University.
- Mamarbachi, R, Day, M, Favato, G. (2008): “Art as an Alternative Investment Asset”, Henley-on-Thames: Henley Business School.
- McAndrew, C. (2019): “The Art Market 2019”, Art Basel & UBS Report, 408 p.
- Mei, J.; Moses, M. (2002): “Art as an Investment and the Underperformance of Masterpieces”, *The American Economic Review*.
- Melendez, S. (2017): “This Startup Will Make It Easier To Brag You Own A Picasso”, April 13th. Fast Company. Available at: <https://www.fastcompany.com/3069253/the-yc-funded-company-pioneering-data-driven-art-investing>
- Pownall, R, Graddy, K. (2016) “Pricing color intensity and lightness in contemporary art actions”, *Research in Economics*, Venice: University of Venice.
- Renneboog, L. and C. Spaenjers (2013): “Buying beauty: on prices and returns in the art market”, *Management Science*, 59, 1, 1-18.
- Rosen, S. (1974): “Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition”, *Journal of Political Economy*, 82, 34-55.
- Stepanova, E., (2015): “The Impact of Color Palettes on the Prices of Paintings”, available at SSRN: <https://ssrn.com/abstract=2807443>.
- Taylor, D. and L. Coleman (2011): “Price Determinants of Aboriginal Art, and its Role as an Alternative Asset Class”, *Journal of Banking and Finance*, 35, 1519-1529.
- Worthington, A. C. and H. Higgs (2005): “Financial Returns and Price Determinants in the Australian Art Market, 1973-2003”, *The Economic Record*, 81, 253, 113-123.
- Vosilov, R. (2015): “Sculpture as an Alternative Investment: An Analysis of Price Dynamics between Sculpture and Equity and Bond Markets”, *The Journal of Alternative Investments*, Spring, 21-45.