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Is art a safe haven in times of political or financial crisis? We trace the long-term performance of the UK art market during world wars, economic recessions, financial crises, inflationary periods, and changes in monetary policy. We digitalized historical auction archives to construct art price indices from the early 20th century onwards. Annual art auction value grew, in real terms, more than seven-fold over the past century. The arithmetic annual real return amounts to 3.6% and risk to 20.1%. Art returns plummeted at the onset of wars, but in the later years of war periods, returns turned positive and outperformed equities, which suggests that art could serve as a hedge against political uncertainty. During wars, smaller and thus transportable paintings obtained higher returns. Art is sensitive to economic and financial crises, with the largest slumps occurring in the Post-WWI recession, the Great Depression, the oil crisis, the recessions of the early 1980s and early 1990s, and the Great Recession. By far the largest declines in art returns occurred in 1931 (-63%), and for the post-WWII period in 1991 (-37%) when the largest art market bubble in art history burst. We highlight changes in art preferences for specific paintings by size, art school, art objects' liquidity, and artists' nationalities during different crises. We report that art enters a broad optimal asset portfolio both in non-crisis periods and during war times.

JEL Classification: G01, G11, Z11, E30, N14, N24, N44

Keywords: art markets, wars, Crises, cultural economics, economic history

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Art in Times of Crisis

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Keywords: art market; art pricing models; art auction, economic recession, financial crisis, economic history, portfolio optimization.
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Art in Times of Crisis

1. Introduction

In January 2021, Sandro Botticelli's *Young Man Holding a Roundel*, one of the most significant portraits of any period within art history ever to appear at auction, was hammered at a record price of USD 80 million (approximately USD 92 million, including the commission) at Sotheby's New York. The artwork by the Renaissance painter was being sold by the estate of the late real estate billionaire Sheldon Solow, who had bought the painting at Christie's London in 1982 for merely GBP 810,000 (USD 1.1 million). Prior to its sale, doubts were raised about the willingness of global art collectors to invest in art amid the COVID-19 pandemic and considering the high equity market volatility. To stimulate demand from collectors and potential bidders, Sotheby's spent four months on a marketing campaign, displaying the painting around the world. This resulted in a new auction record for a Botticelli painting. The hammer price was also the highest price paid for an Old Master since Leonardo da Vinci's *Salvator Mundi* was sold for USD 450 million in 2017. This example suggests that considerably large returns can be obtained from artwork sales, even in times of crisis (in this case, a global pandemic). Even more surprisingly, Sotheby's sales for 2021 surpass USD 7.3 billion, the strongest total in the company's 277-year history, and its counterpart, Christie's achieved similar annual sales of USD 7.1 billion for 2021, the auction house's third-highest total ever.

In this paper, we ask whether art, in general, is a good investment during crises such as in war times economic recessions, or financial downturns, by digitalizing historical UK auction archives from the early 20th century onwards. Despite the growing popularity of art as an alternative asset class, the role of art as a safe haven or an investment in times of crises has rarely been studied over the long term. This

is mainly because of the lack of art market data availability for long periods. An analysis of art performance in rare disasters are impeded by gaps in data that cause sample-selection problems especially during the worst crises when data is more likely to be missing (Barro and Ursúa 2012). We aim to resolve this limitation by manually collecting historical auction records from various (even handwritten) sources to investigate the long-term performance of art markets and its determinants from the early 20th century onwards.[1] The micro-level auction datasets enable us to estimate the prices and returns over the long run including the most difficult periods (e.g., wars) and also provide us with cross-sectional details of the art market. We focus on the British (mainly London) art market—the most important market for the larger part of that century and one of the dominant markets to date. The 20th century is characterized by numerous crises, from political to economic and financial shocks, each of which might have left their mark on the risk and returns of the art market (segments) (Reinhart and Rogoff 2011). Our rich datasets enable us to provide a detailed overview of the evolution of the British art market over more than a century, including the pre-war period, World War I, the interwar period and Great Depression, World War II, the Bretton Woods period, and the post-Bretton Woods era.

The development of the art market per se crucially depended on the emergence of mass demand and the evolution of mechanisms for selling works of art either directly by artists (or their representative galleries) or via intermediaries, such as dealers and auctioneers (Hook 2017). During the past centuries,

[1] Goetzmann (1993) and Goetzman, Renneboog and Spaenjers (2011) also study the art market over the long run. However, their datasets are sparse and may suffer from selection bias in terms of coverage (subjective choices of artists included). In addition, the use of repeat sales further reduces the sample size and there are no cross-sectional details. For example, Goetzman et al. (2011) work with 1,096 sales pairs from the Reitlinger (1961) data covering several and ending in 1961. In contrast to previous studies, we apply newly constructed datasets with large coverage of sales and with sales in difficult years (such as wars) that are usually not covered in earlier datasets. So, our datasets are less affected by selection bias and enable us to provide cross-sectional details of the art market over the long run.

new art movements arose, first selling on the primary market through galleries and, subsequently, as demand grew, through the secondary market, comprising both a private market (through dealers) and a (public) auction market. In the second half of the 15th century, primary markets for paintings arose as a derivative of the market for commissioned artwork in places such as Bruges and Florence. As markets emerged in the 16th century with non-commissioned artwork on offer, dealers and agents emerged as specialized art professionals, for instance, in Antwerp, which turned into one of the main European centers of art production (Vermeylen 1999). In the 17th century, art collecting became a more visible activity, and professional intermediaries, especially dealers, dominated the art market (Jonckheere and Vermeylen 2011). Regular auctions of paintings were held by the Amsterdam Orphan Chamber in the early decades of the 17th century. The first auctions for which there remain printed catalogs with rules were held in London later in that century (De Marchi and Van Miegroet 2006). While the 17th century was the era of the dealer, the 18th century was the era of the auctioneer. The most reputable auction houses, such as Sotheby's (London) and Christie's (London), were founded in 1744 and 1766, respectively. In the closing years of the 18th century, two other auction houses were founded in London: Bonham's in 1793 and Phillips in 1796; these businesses also persist to the present day.

The art markets of the 20th century were defined by the two world wars, the triumph of modern and contemporary art, as well as the chase for record prices, and by the end of the century, the rise of the Internet. The growth of modern art markets reflects the culture of societies, but the evolution of art prices also follows the concentration of wealth and economic development. As such, the evolution of the art market has been closely associated with an increasing interest in art as an investment because art has a dual nature. It not only yields an "aesthetic dividend" derived from the ownership of these "passion" investments or collectibles but is also expected to be a store of value and even yield positive real returns

(Renneboog and Spaenjers 2013). Given the low correlation of alternative investments, such as art, with traditional financial assets (equities, bonds, commodities), investing in art can expand the efficient portfolio frontier (Li, Ma, and Renneboog, 2021). Consequently, art can take on a role as an investment diversification vehicle and a hedge against inflation.

To investigate how art prices, returns, and volume evolve in acute crises and intermittent quiet periods, we follow the chronology usually adopted in economic history by distinguishing the following periods: the pre-World War I period (1907–1913), World War I (1914–1918), the interwar period and Great Depression (1919–1939), World War II (1939–1945), the Bretton Woods period (1944–1973), and the post-Bretton Woods era (1974 onwards), which includes the Great Recession (2008–2010). We assess the relations between, on the one hand, the art market and, on the other, macroeconomic indicators (e.g., changes in GDP, national debt, inflation, exchange rates, term structure, and income inequality), financial markets (equity, bond, and treasury bill markets), and other alternative investments markets (e.g., gold and housing). We focus on crises and how art markets react specifically to wartime shocks, financial crises, and systemic troubles. Furthermore, we study the cross-sectional performance of art by price segment, by liquidity, by size and by artists' nationality across crises. Finally, we investigate the role of art as an investment by assessing optimal portfolio allocations by including and excluding art in broad asset portfolios for non-crisis periods, economic and financial crises, and war times.

2. Literature Review

The idea to invest in art—to generate a financial return—dates at least to the beginning of the 20th century with the creation in 1904 of *La Peau de l'Ours*, which is, to the best of our knowledge, the first

fine art fund (Horowitz 2011). The view (by some collectors) of art as an investable asset class, and salient mentions of record-breaking prices at auctions have prompted scholars to analyze whether investing in art is financially worthwhile. Financial literature has focused mostly on the risk–return relationship of art (Goetzmann 1993, Frey and Eichenberger 1995, Mei and Moses 2002, Renneboog and Spaenjers 2013, Korteweg, Kräussl, and Verwijmeren 2015, Lovo and Spaenjers 2018), its macroeconomic market drivers (Goetzmann, Renneboog, and Spaenjers, 2011), sentiment and hype (Pénasse, Renneboog, and Spaenjers 2014), gender biases (Adams et al. 2021; Bocart, Gertsberg, and Pownall 2021; Cameron, Goetzmann, and Nozari 2019), art market bubbles (Pénasse and Renneboog 2022), artist's death as a supply shock (Pénasse, Renneboog, and Scheinkman, 2021), and behavioral anomalies, such as anchoring (Beggs and Graddy 2009).

Numerous studies reveal consistent results on the procyclical relationship between the art market evolution and the performance of other assets. Goetzmann (1993) demonstrates that art indices are positively correlated with equity markets over the period 1715–1986. Hiraki et al. (2009) document that Japanese demand for art from the mid-1980s—instigated by a boom in the Japanese property market—strongly positively affected international—and especially French—art prices, culminating in the largest bubble ever, which deflated in the early 1990s. Pénasse and Renneboog (2022) examine the role of demand fundamentals and speculative trading in art price dynamics. They show that price run-ups are followed by predictable busts and rationalize this finding using a model in which extrapolative beliefs fuel speculative bubbles.

Mandel (2009) argues that art serves a dual purpose for the investor. It combines investment characteristics and consumption features that yield an aesthetic dividend and, in some cases, a "conspicuous consumption" dividend if owning an artwork enables investors to show off and enhance

their social status. These various functions of art—investment, consumption good, and status object—induce heterogeneity in beliefs about the value of a piece of art (Lovo and Spaenjers 2018; Pénasse, Renneboog, and Scheinkman 2021). The right tail of the belief distribution drives prices upward, while the left tail, which captures pessimism, has less of an impact because short selling of art is not possible. Goetzmann, Renneboog, and Spaenjers (2011) investigate how equity returns and the personal income of the wealthiest part of the population determine the price of art. They find cointegrating relationships between top incomes and art prices, which supports the Veblenian view of art as an instrument of social competition among the very rich.

Despite these numerous studies and the common assertion that art may be viewed as a safe-haven investment, the performance of the art market during crises has hardly been investigated. The evolution of the art market in occupied countries during World War II represents an exception. Euwe (2007), David et al. (2017), Euwe and Oosterlinck (2017), and Oosterlinck (2017) analyze the Belgian, Dutch, and French markets and report a trading boom in the art market during this war. Oosterlinck (2017) shows that the Parisian art market largely outperformed stocks and bonds (in terms of risk–return trade-off). He attributes this boom to several intrinsic characteristics of artworks: Art may have been an inflation hedge, could be legally sold in occupied France (unlike gold and foreign currencies), and could have been sold discretely or resold abroad. In this context, art could have acted as a safe haven in times of crisis or at any time when concerns about discretion were high, leading to the portability of art and ease of hiding being increasingly important. However, this conclusion was derived for art trading during World War II and may not be generalizable. Previous literature focuses solely on occupied countries, whereas the art market may be entirely different for non-occupied countries. Furthermore, the dynamics of art prices during other wars may be different (see David, 2016 for France during World War I) or

similar (see Enderlein 2006 and Alvi 2020 for Germany during World War I), nor would they apply to other types of crises, such as economic recessions and financial upheavals.

Owing to limited data availability, the interrelationship of art markets and macroeconomic factors has rarely been studied. Thus, the role of art as an investment during political and economic crises remains unclear. In this study, we use micro-level auction observations and analyze the performance of art markets during times of war, monetary policy changes, and various other crises. To the best of our knowledge, this study is the first to focus on art markets in the long run, with a large sample of cross-sectional detail focusing on major crises.

3. Data and Methodology

3.1 Data

3.1.1 Art Data Sources

Two sources are used to construct the data series predating the 1960s: *Art Prices Current* and *Christie's Auctioneers' Book*. The former was first published by *Fine Art Trade Journal* in London in 1908, and the series covered auction records from 1907 until 1973. This book series was initially dedicated to the British art auction markets and later expanded to the global auction records in 1932 (although the coverage of the British market is more extensive). It tracked paintings, drawings, and engravings sold at major British auction houses (among which the most prominent were Christie's, Sotheby's, and Puttick & Simpson) as well as auction houses outside Britain (e.g., Parke-Bernet Galleries and Hôtel Drouot). As there were no publications between 1917 and 1920, we bridge the gap by collecting the catalogs in *Christie's Auctioneers' Book* at the Christie's Archives in London. In those days, Christie's was responsible for more than 90% of the UK art auctions in *Art Prices Current*; thus,

the potential bias based on the use of different sources is likely to be limited.

Both *Art Prices Current* and *Christie's Auctioneers' Book* systematically provide descriptions of auctions and artworks sold. Each catalog includes the artist's name, the title of the auctioned artwork, its dimensions, hammer price, the presence of a signature or date, the auction house, the auction date and title, and sometimes, but only rarely, the buyer's name. Some limited provenance information on past sales and exhibitions may be reported. We encode all the historical records with artist, artwork, and transaction information, and focus on the market for oil paintings and works on paper (i.e., watercolors and drawings), which account for a substantial proportion (over 70%) of all art transactions. We add to the *Art Prices Current* dataset, which covers 225,814 auction observations over the period 1907–1960, an additional 28,142 observations for the missing years from the *Christie's Auctioneers' Book*. We exclude all lots comprising multiple items (e.g., a set of paintings), as no price information on the constituent paintings is provided. For the period 1961–2016, we use the Hislop's Art Sales Index and the Blouin database.[2,3] The long time window and denseness of our datasets enable us to draw a more complete picture of the evolution of art prices in the United Kingdom and the growth of modern art auction markets.[4]

Our dataset comprises 616,844 sales in UK auction houses: 436,959 (70.8%) are oil and acrylic paintings ("oils" henceforth), 92,085 (14.9%) are watercolors and gouaches, and 87,800 (14.2%) are

[2] For the emerging new artists active in the 21st century, we exclude the artists who are only auctioned rarely and require that the artists included in the Blouin dataset have a market of at least 50 transactions.

[3] The Blouin database gives either the hammer prices or the premium price, which is the hammer price plus a commission averaging 15%, paid by the buyer. Given that the actual percentage of the commission is not available, we divide the premium price by 1.15 as an approximation of the hammer price. The hammer price is then deflated by UK CPI, taking 2016 as the basis year.

[4] The concatenation of databases is visible in 1961, which we will correct for in the regression analysis. The return in 1961 is set as missing in the return analysis as a robustness check, and the results remain similar (not tabulated).

drawings. As the observations are sparse before the 1930s for watercolors and drawings, we use only oil paintings in our main analysis.[5] To address the impact of inflation, the nominal prices are converted into real 2016 prices using the inflation rate from the Office of National Statistics.[6] On average, approximately 3,200 paintings were sold in the United Kingdom per year prior to 1960, and since the 1980s, this has increased to about 5,000.[7] By eyeballing the sales time series, several major crises can be readily observed (sometimes with a lag): World War I, World War II, the financial crisis at the end of the 1980s (after which the art bubble burst), the bursting of the dot.com bubble (2000), and the Great Recession (starting in 2008).

3.1.2 Macroeconomic and Financial Data

We obtain macroeconomic time series for the United Kingdom from various sources, including the Maddison Project Database, the Barro-Ursúa Macroeconomic Data, the Jordà-Schularick-Taylor Macro-history Database, Global Financial Data, the World Inequality Database, and the Dimson-Marsh-Staunton Global Returns Dataset. For robustness checks, we collect similar time series from various sources listed in Online Appendix IX and summarized as follows.

- The Maddison Project Database[8] was compiled by Angus Maddison and is currently extended and updated by Jutta Bolt and Jan Luiten van Zanden. It comprises estimations of GDP and population sizes for the past two millennia. We use the UK GDP data.

[5] The results of the full sample (including oil paintings, watercolors, and drawings) are included in the Online Appendix VI as a robustness check.

[6] The website for the Office of National Statistics is: https://www.ons.gov.uk

[7] As *Art Prices Current* only started the records in November 1907 (758 transactions in total in 1907), we use the sample since 1908 to construct the price indices and returns in our main analysis.

[8] The database website is: https://www.rug.nl/ggdc/historicaldevelopment/maddison/?lang=en

- The Barro-Ursúa Macroeconomic Data[9] was constructed by Robert Barro and José Ursúa to support a broad research agenda focused on the study of macroeconomic rare disasters, long-run volatility, long-run trends, growth properties, and their asset pricing implications. It includes GDP, consumption, and population series of 42 countries. We obtain UK GDP and consumption data from this source.
- The Jordà-Schularick-Taylor Macro-history Database[10] was constructed by Òscar Jordà, Moritz Schularick, and Alan Taylor. The database combines information from various sources and spliced series to create long-run datasets spanning the 1870–2016 period; it is the most extensive long-run macro-financial dataset to date. The database covers 17 advanced economies since 1870; it comprises 45 annual real and nominal variables, among which financial variables, such as bank credit to the non-financial private sector, mortgage lending and long-term returns on housing, equities, bonds, and bills. We gather both UK macroeconomic series (e.g., GDP, money, exchange rates, imports and exports, government revenues and expenditure, and credit) and financial series (equities, bills, bonds, etc.).
- Global Financial Data[11] contains historical, financial, and economic data on 200 countries, including the following: long-term historical indices on stock markets; total return data on stocks, bonds, and bills; interest rates; exchange rates; inflation rates; bond indices; commodity indices; and prices. We obtain UK commodity series and financial series (equities, bills, bonds, etc.) from this database.

[9] The database website is: https://scholar.harvard.edu/barro/publications/barro-ursua-macroeconomic-data

[10] The database website is: http://www.macrohistory.net/data/

[11] The database website is: http://www.globalfinancialdata.com/

- The World Inequality Database[12] provides the historical evolution of the distribution of income and wealth. We use the UK net personal wealth in the 99.9th to 100th percentiles as a proxy for inequality.
- The Dimson-Marsh-Staunton Global Returns Dataset offers long-run global asset returns on stocks, bonds, bills, inflation, currencies, GDP growth, and population growth for 22 countries since 1900. We use its UK bond and equity series.

3.2 Methodology

3.2.1 Hedonic Pricing Model

Unlike financial assets, most artworks are characterized by their uniqueness. Their heterogeneous characteristics make constructing indices a complex task. To overcome the heterogeneity problem, repeat sales (for limited samples of round trips) and hedonic regressions (for the full sample of unique and repeated sales) are the main methods applied to construct indices of artworks. The repeat-sales method tracks the prices of an artwork sold at different moments in time. This approach has been widely used in, for example, real-estate-related analysis and alternative investments, such as those in artworks (Baumol 1986; Goetzmann 1993; Pesando 1993; Mei and Moses 2002). The method controls for the uniqueness of each painting, and the returns of the repeat sales are regarded as investment returns in the literature. Despite its intuitive appeal, the repeat-sales method suffers from a series of drawbacks, such as dramatically shrinking the sample size and sample-selection biases, as only a small percentage of artworks is resold in the market. Many artworks may not appear in the market twice, for instance, when they are bought by museums or collectors (Ginsburgh, Mei and Moses 2006). Even over long time

[12] The database website is: https://wid.world/

windows, repeat sales amount to only a fraction of the total transactions (e.g., approximately 4% in the study of Renneboog and Spaenjers 2013). Some paintings may enter or return to the art market for reasons imposed on the owner by the four Ds (death, debt, divorce, and disaster). If paintings have a short holding period, it may be difficult to compensate the transaction costs (which amount to approximately 20%–30% for a round trip). Speculative transactions can still be lucrative if an artist quickly rises to notoriety or when the art market (or some of its segments) booms. Repeat sales may also include a bias in that the paintings returning to the auction market may be special—perhaps of higher quality. Further, when the works of an artist fall out of fashion, and hence, the artist's oeuvre does not return to the art market, the collectors' loss related to reduced marketability is not recorded. Therefore, a hedonic model is frequently used in which assets have unique characteristics and markets are illiquid. The (log) price of the artwork is regressed on a set of attributes, which yield their shadow prices (Renneboog and Spaenjers 2013; Oosterlinck 2017). The main advantage of this method is that information on all observed transactions is considered; hence, it becomes possible to work with very large samples, even close to the population of auctioned artworks. In our study, we estimate the following hedonic model:

$$\ln(P_{it}) = \alpha + \sum_{m=1}^{M} \beta_m X_{mit} + \sum_{t=1}^{T} \gamma_t D_{it} + \varepsilon_{it} \quad (1),$$

where P_{it} represents the price of art object i at time t, X_{mit} is the value of characteristic m of item i at time t, and D_{it} is a time dummy variable that equals 1 if object i is sold in period t (and 0 otherwise). The coefficients β_m are the shadow prices of each of the m characteristics, and the coefficients γ_t reflect the time trend used to construct an art price index. If we denote the coefficient before year t as γ_t, then the hedonic index for year t is

$$\Pi_t \equiv \exp(\hat{\gamma}_t) \times 100 \quad (2),$$

with the time dummy coefficient set to 0 for the first left-out period. This gives an estimated return in year *t* of

$$r_t \equiv \frac{\Pi_t}{\Pi_{t-1}} - 1 \quad (3).$$

The above index (Equation (2)) may lead to an overestimation of returns because, according to Jensen's inequality in the case of a concave function, the expectation of the log function at one point is higher than the log of the expectation. Therefore, following Triplett (2004), Silver and Heravi (2007), and Renneboog and Spaenjers (2013), we assume that the hedonic regression residuals are normally distributed in each period and define the adjusted index as follows:

$$\Pi_t^* \equiv \exp\left(\widehat{\gamma_t} + \frac{1}{2}(\hat{\sigma}_t{}^2 - \hat{\sigma}_0{}^2)\right) \times 100 \quad (4),$$

where $\hat{\sigma}_t$ and $\hat{\sigma}_0$ are the estimated variances of the residuals of observations in periods *t* and 0, respectively. The adjusted return estimate in year *t* is then defined as

$$r_t^* \equiv \frac{\Pi_t^*}{\Pi_{t-1}^*} - 1 \quad (5).$$

Hedonic Variables

We include the traits and characteristics of the artist, painting, and transaction in the above model (Equation (1)).[13]

The *artist traits* comprise the following elements.

- Artist: Artist fixed effects capture each artist's uniqueness and reputation.
- Deceased: This dummy variable equals 1 if the sale occurs after the artist's death and captures the effect of a possible supply shock of an artist's death on prices (Pénasse, Renneboog, and Scheinkman 2021).

[13] Detailed definitions are provided in Online Appendix I, and an overview of the descriptive statistics of the hedonic variables is given in Online Appendix II.

- Movement: We classify the artists according to the following art movements: *Medieval and Renaissance*; *Baroque*; *Rococo*; *Neoclassicism*; *Romanticism*; *Realism*; *Impressionism and Symbolism*; *Fauvism and Expressionism*; *Cubism, Futurism, and Constructivism*; *Dada and Surrealism*; *Abstract Expressionism*; *Pop*; *Minimalism and Contemporary*. Not every artist can be classified into a school; only about 42.3% of the artists are thus allocated, based on the Grove Dictionary of Art/Oxford Art Online.

In relation to the *artworks' characteristics*, we consider a wide range of price-determining variables that capture attribution, authenticity, medium, size, and topic of the artwork, as follows:

- Attribution: Six levels of attribution are used in the auction world: *Attributed* (to), *Studio* (of), *Circle* (of), *School* (of), *After*, and (in the) *Style* (of). Studio/Circle/School mainly appears for those schools of art at times when artists often collaborated or worked with pupils (e.g., in the baroque period). "Attributed to" appears throughout art history and captures art historians' doubts about the real authorship of an artwork.
- Authenticity: We include variables that capture whether the painting is *Signed*, *Dated*, or *Inscribed* (e.g., an inscription in the list).
- Medium: We distinguish between *Oil* (and acrylic) paintings, *Watercolors* (and gouaches), and *Drawings*.
- Size: The height and width in centimeters are captured by *Height* and *Width*, respectively (we also include the squared values *Height Squared* and *Width Squared*, as there is a natural size limit to an artwork for the average collector).
- Topic: As the subject matter can affect the aesthetic appreciation of art objects, we categorize the paintings/drawings by topic based on the keywords of the artworks' titles. The textual

analysis of the titles is executed in the six languages most often used in the art auction world and art history (English, Dutch, French, German, Italian, and Spanish).[14] We identify 13 topic categories: *Abstract*, *Animals*, *Landscape*, *Seascape*, *Urbanscape*, *Nude*, *People*, *Self Portrait*, *Portrait*, *Religion*, *Still Life*, *Study*, and *Other Topics*.

- Provenance: We capture whether information on pedigree, exhibition, literature, and authentication related to the artwork is available in the auction catalog.

The *transaction characteristics* are captured by indicator variables denoting the timing of the sale and the reputation and location of the auction house (at the branch level), as follows:

- Year and month: We control time effects and seasonality. In the auction world, the spring (in May and June) and fall auctions (in November and December) are the busiest and most important of the year.
- Auction houses: We distinguish among different fine art auction houses: *Christie's*, *Sotheby's*, and other (smaller) auction houses.

Regarding the physical evidence confirming or supporting an oil painting's authenticity, we document that 37% are signed, 22% are dated, and 8% are inscribed. An average painting in our sample is 64 cm in height and 68 cm in width. Further, 37% of paintings do not have a clear topic that can be determined through textual analysis of titles. The most common non-abstract topics are landscapes (18%) and scenes with people (17%). The spring (June/July) and fall (November/December) seasons account for approximately 50% of yearly sales. Christie's and Sotheby's are the most prominent auction

[14] For our other string searches in the six languages, we compile a set of keywords (and their synonyms), all of which are verified by native speakers. The details of the string searches are listed in Online Appendix X.

houses, and handled 27% and 48% of the art transactions in our sample, respectively.[15] Most explanatory variables are strongly statistically significant in virtually all models. For the sample of oil paintings over the whole period, the model explains more than 71% of the price variation (the adjusted R-squared is 40%–50% lower during the wars and the interbellum).[16]

3.2.2 Return Unsmoothing

Using the coefficients of the year fixed effects (Equation (1)), we derive the art price index series. Underestimating the true volatility may be a problem for less liquid assets, such as art, owing to the lack of a continuous auction market. Hence, the first differences in index levels may suffer from autocorrelation. To adjust for the smoothing present in the return series, we apply an unsmoothing method, following Geltner (1993) and Dimson and Spaenjers (2011). If we assume that all items are reappraised at the end of each period, the observed (smoothed) return in period t, R_t, can be expressed as a weighted average of the true (unsmoothed) return in period t, R_t^u, and the smoothed return in the previous period, R_{t-1}:

$$R_t = (1-\alpha)R_t^u + \alpha R_{t-1} \quad (6).$$

The appraisal smoothing factor α is a fraction between 0 and 1 and is the autocorrelation coefficient.[17] Equation (6) can be inverted to obtain the unsmoothed return series R_t^u from the observed returns R_t and R_{t-1}:

[15] The descriptive statistics of the full sample (including oil paintings, watercolors, and drawings) are considerably similar to those of oil paintings.

[16] The results from the hedonic regression for the complete sample and subsamples based on the various periods are given in Online Appendix III.

[17] Assuming that the smoothed series follows an AR(1) process, we can set coefficient α equal to the autocorrelation coefficient at lag 1. This newly constructed series then has a first-order autocorrelation considerably close to zero. In our sample, the autocorrelation coefficient at lag 1 for the unadjusted index is 0.1402, and that for the adjusted index is 0.0654.

$$R_t^u = \frac{R_t - \alpha R_{t-1}}{1 - \alpha} \quad (7).$$

Subsequently, we obtain the adjusted standard deviation from the unsmoothed returns R_t^u.

4. The Evolution of Art Prices over Time

Over the course of more than a century, the art price level, depicted in Figure 1 (and listed in Table 1), increased in real terms more than sevenfold (from 100 in 1908 to 707 in 2016),[18] reflecting the growing importance of the London art market. The art markets remained rather stable until the end of the 1950s, and the main increase started in the mid-1950s. By 1960, the index had reached only a value of 98, signifying that over the first 60 years of our time window, the increase in the art market index was lackluster. Subsequently, prices increased drastically, consistent with the observations of Rush (1961). The art-price-level continued to grow until 1973, when it first peaked (at 464) but then dropped as a result of the oil crisis, which induced a crash of more than 30% over the subsequent two years (the index fell to 295 in 1975). The price levels kept regressively declining until 1982, bottoming at 243, which was almost half of its peak level a decade earlier. From 1982, an unprecedented surge in art prices took place until 1990 when a new peak of 855 was reached, at which point the bubble burst, with art prices falling by more than 30% in 1991. Prices kept declining to approximately half the peak index value by 1998 (439). Subsequently, art surged in the period prior to the Great Recession (up to 2007), when it peaked at the highest index point of the century (at 839). In the aftermath of the financial crisis and in subsequent years (until 2016), the trend in art market prices was generally negative. In this section, we relate the art-price-movements depicted in Figure 1 to the main political, financial, and economic events in the corresponding periods. As the increase experienced over the second half of the century

[18] We use the adjusted index and returns of oil paintings in our main analysis.

dwarfs the price changes from the first half, it may be difficult to assess price movements based on Figure 1. Thus, we turn to Figures 2 and 3, which show the art index and the volumes over the first and second halves of our time window.

[Insert Figures 1–3 about here]

4.1 Pre-War Period (1907–1913)

During the gold standard period, the economies of the most economically advanced countries were characterized by fixed exchange rates and large movements of capital. More importantly, and as pointed out by Fletcher and Helmreich (2011), London was a global financial center and a center for global commodity exchanges. London was also the capital of an empire that extended across vast parts of the globe, and as such, a hub for international trade. British commodities and services were massively exported and marketed throughout the empire (Floud and Johnson 2010). This generated a large influx of capital in the London financial market, apparently reflected in the art price index, which increased from 1908 to 1910 (reaching an index level of 112). This movement is quite similar to that observed in France, for example, where the influx of foreign capital, particularly from U.S. newcomers to the market, led art prices to a higher level (Seligman 1961: 30, David 2016). At the time, demand for artworks was indeed high in the United States with important collectors (e.g., John Pierpont Morgan, Peter Arrell Browne Widener, Benjamin Altman, and Henry Clay Frick) vying to obtain the artworks they coveted. For example, at the beginning of the 20th century, American collectors paid more than GBP 100,000 for a Van Dyck and a Raphael (Reitlinger 1961: 181). These sales were made by art dealers who at the time still held a more preeminent role than auction houses (Watson 1992: 164). However, in this period, the augmenting art-price-levels reflected the gradually growing importance of auction houses on the art

market. Subsequently, Christie's and Sotheby's became two of the most prominent players on the market. Watson (1992: 164) pinpoints this change to 1908, when Sotheby's was sold to Sir Anderson Montague-Barlow. The years preceding World War I have often been presented as extremely good for the art market. Reitlinger (1961: 202) describes 1913 as an "annus mirabilis," which is confirmed by Watson (1992: 168), who also considers 1928 and 1989 as exceptional years for the art market. David (2016) observes that the French art index peaked in 1913, and our results confirm this is the case for the British market as well.

4.2 World War I (1914–1918)

The outbreak of the war on July 28, 1914, changed the dynamics of the art market. The index fell rapidly and reached the first low in 1915 (index at 55); art markets did not recover in a devastated Europe, and a second low appeared in the wake of the war in 1921 (index at 31). Unlike in France, where the outbreak of the war brought auctions almost to a halt, auction houses in the United Kingdom closed only for a short period—at the war's onset. Sotheby's stopped sales until the end of 1914, and Christie's experienced a slump in business following the commencement of the war but resumed sales aimed at raising funds for the war effort (Watson 1992: 199). By the spring of 1915, sales were back on track at Christie's. In general, the market remained active during the war, as shown in Figure 2. In terms of sales, the number of artworks sold dropped in 1914 but reached numbers comparable to the pre-war level in 1916. Prices for contemporary works and portraits notably dropped, and many artists struggled to make ends meet (Stephenson 2012). Although the war disrupted international trade, the United Kingdom was not cut off from the international art market, as the United States remained an important buyer during the war (Reitlinger, 1961: 219). The most important long-run economic effect of the war

was the destruction in 1914 of the gold standard, the international monetary equilibrium that had allowed globalization to reach unprecedented levels (Harley 2010).

4.3 The Interwar Period and Great Depression (1919–1939)

Our index shows a decline following World War I, which is consistent with the slump of 1920 mentioned by the art dealer Agnew's (Agnew 1967: 48). Conversely, the market for contemporary works seems to have experienced a short-lived boom (Stephenson 2012: 60), which coincided with an export boom immediately after the war accompanied by continuous inflation (Harley 2010). The economic boom, supported by American lending and monetary expansion, ended abruptly in 1921 when the Federal Reserve took measures to curb inflation and bring real prices of goods and services down toward pre-war levels. In Britain, the Bank of England started a regime of tight monetary policy to return to the gold standard, at pre-war levels (Eichengreen 1995). The return to the gold standard took place in April 1925, much earlier than in other European countries. Over this whole period, characterized by discussions about the return to the gold standard and the overvalued level of the pound sterling, the art index showed a massive increase until 1929, reaching a value of 115, as shown in Figure 2.[19] According to Fletcher and Helmreich (2011), this reflects an increase in conspicuous consumption. Watson (1992: 204) connects the increase in art sales to the rise in prosperity following the war and increasing American interest in visual arts. Agnew (1967: 48) tracks the increase in wealth to the war itself, pointing to the fortunes that had been made at the time. According to Seligman (1961: 177), the "New York art market had never been more active than in the mid-twenties." Despite the collapse of

[19] This strong increase did not take place across all art movements. Many galleries dedicated to contemporary artists were forced to close as early as 1923 (Stephenson 2012: 63). They recovered only in 1926 but were then hit by the Great Depression.

the comparative advantage of Britain's old export industries during the interwar period, London maintained its position as a global financial and art trading center (Harley 2010).

The economic expansion ended abruptly with the 1929 stock market crash and the subsequent Great Depression. The art market was hit hard by the financial crisis, and the index from 1929 drastically plunged to a minimum in 1932 (the index halved to a value of 34). According to Reitlinger (1961: 207), the effects of the economic and financial crash became noticeable in art prices after November 1929, which is consistent with our results. The crash marked the end of the competition between millionaires to acquire art and also affected transaction volumes, as in 1929, there was a fall in the number of artworks put up for sale (from 3,285 to 2,569 in our sample),[20] although auction volumes had already started to decline from 1927. This sharp decline was not limited to auction houses but was also felt by art dealers, such as Agnew's (Watson 1992: 227). The high-end of the market suffered, with paintings auctioned for at least 1,400 guineas falling from 130 in 1927 to 63 in 1930 and 13 in 1931 (Reitlinger 1961: 209). The market for modern art was not spared, experiencing a downturn already in 1930 with few sales (Stephenson 2012: 63). Business for major art dealers also almost came to a halt with only high-end pictures finding buyers (Agnew 1967: 51). Although the situation was bad in Europe, according to Seligman (1961: 168), it was even worse in the United States[21].

In September 1931, Britain was forced out of the gold standard. Despite the advantage effected by the devaluation of the British pound, the art market started to recover only by 1933, reaching an index value of 39 (Figure 2). In the following years, the art index hovered around 40, ending at a value of 34

[20] Reitlinger (1961: 209) highlights the same pattern.

[21] Rush (1961) relies on repeated sales of a dozen works from the Billings Collection by the American Art Association to estimate the price decline in the United States between 1926 and 1934 and finds a staggering decline of 74%. However, it is difficult to disentangle changes in taste and the effect of the Great Depression, given the limited number of works Rush (1961) considered.

at the outbreak of World War II in 1939. This art price decline during the Great Depression probably also reflects the contraction in global trade (Kindleberger 1973) and the restrictions imposed on currency exports prevailing in many countries at the time. Despite this strong contraction, Faith (1985: 36) suggests that the Great Depression had positive effects on the art market, as it created "a feeling that works of art had a certain defensive worth, that they lost their value less than stocks and shares."[22] Seligman (1961: 166–168) describes the different reactions he witnessed: Several art collectors tried to renege on the deals they had made, one collector filed for personal bankruptcy, and another collector who owed large sums of money committed suicide. Conversely, Seligman (1961: 167) mentions collectors whose art investments retained their value or even improved during the crisis. One of his clients told him after having purchased a painting, "My stocks are bringing me nothing, my rental properties are eating themselves up… My works of art are the only assets I own which I know will still have a value and the only investment worth making just now."

4.4. World War II (1939–1945)

The outbreak of the war strongly affected art transaction volumes, with the number of paintings auctioned falling from 3,691 in 1938 to 2,559 in 1939 and merely 1,460 in 1940. Reitlinger (1961: 219) also notes this decrease in activity. However, his assertion that prices remained steady during the Phoney War (October 1939 to April 1940) is contradicted by our index, which fell by 25%: from 40 in 1938 to 34 in 1939 and further to 30 in 1940. The price fall at the outbreak of the war is also observed in France (Oosterlinck 2017). Nicholas (1995: 86–87) notes the low level of transaction activity during this period, after which prices began to rise. Bernier (1977: 145) suggests that the art market activity resumed

[22] Faith (1985: 36) further mentions an anecdote related to an American banker, George Blumenthal, who considered a 30% loss on his artworks hardly an issue as he had lost 75% on his financial securities.

strongly in 1942, subsequent to the heaviest bombings of Britain by the German air force and the stalemate of the German army in Stalingrad. Reitlinger (1961: 209) attributes a sustained level of art transactions to the Allied landings in Italy, which was considered a signal that the occupation of continental Europe would come to an end. Further, Watson (1992: 267–268) stresses the role played by refugees to the United Kingdom, who brought art objects with them, thereby boosting the art trade. Moreover, Agnew (1967: 54) suggests that the inability to buy other real goods and the psychological need to be able to forget the war momentarily played an important role in art trade: "they [buyers] found an escape from the dreariness of wartime conditions in visiting the small exhibition of modern and old pictures which we held in the front gallery." Over the course of World War II, the market recovered, with the index reaching 75 in 1945. By 1945, the evolution of the art market had left the finances of Sotheby's in an extraordinarily healthy situation (Watson 1992: 272). In the Netherlands, the art market experienced an impressive boom (Euwe 2007, Euwe and Oosterlinck 2017), as was the case in occupied Belgium (David and Oosterlinck 2015, David et al. 2017). The price evolution in the United Kingdom contrasts somewhat with price movements in occupied France, where a strong price increase during the occupation led to a peak in 1942 (French art prices increased threefold in real terms between 1937 and 1942), followed by a gradual decline (Oosterlinck 2017).

4.5 Bretton Woods (1944–1973)

The end of World War II led to the creation of a new monetary system in Western Europe (Toniolo and Clement 2005). The Bretton Woods agreement provided for the establishment of an adjustable peg, which swiftly turned into a system of fixed exchange rates (Bordo 1993). Gold and the U.S. dollar became the numeraire for international payments as the United States stood ready to exchange dollar

for gold at fixed parity. Economic development following the war gradually ensured that the stock of foreign-held dollars exceeded the U.S. reserves, thereby threatening the stability of the system (Flandreau, Holtfrerich, and James 2003; Rajan and Zingales 2003). This led to speculative attacks on the dollar in the 1960s. This, in turn, forced the United States in 1971 to suspend momentarily the conversion of dollars into gold and negotiate a first devaluation of the dollar, followed by a second one in 1973. This marked the end of the system; the dollar and many other currencies began to float in March of that year (Eichengreen 2011).

Over the course of the aftermath of the war, the art price index decreased to a new low of 54 in 1949. Strong declines of prices and volumes following the war were also observed in France (Oosterlinck 2017) and Belgium (David and Oosterlinck 2015). These declines have been attributed to several factors, such as the fear of monetary reforms or the resale of artworks that had been bought as hedges against inflation. As for the United Kingdom, the period was characterized by a high uncertainty regarding the value of the pound with runs on the currency and a devaluation in 1949 (Cairncross and Eichengreen 1983; Newton 1984; Schenk 2010; Naef 2016). Contemporaneous actors argued that the currency fluctuations induced higher volatility in the art market,[23] with lower-quality artworks being most affected by this uncertainty. In 1950, *The Economist* presented the London art market as the world's leading art center[24]: the structure of the London art market, characterized by dealers with large inventories, rendered prices in London more competitive than anywhere else. Prices increased again from 1953 onwards, which may be linked to the lifting of currency restrictions (Watson 1992: 280). By 1955, prices on the London market were again aligned with those observed in Paris and New York.[25]

[23] See "The London Art Market," *The Economist*, December 2, 1950, pp. 929–931.

[24] Refer to the previous note.

[25] See "Bull in a Picture Shop," *The Economist*, March 5, 1955, pp. 788–790.

In merely a decade, the index moved from a value of 52 (in 1953) to 247 (in 1963). Another important reason behind this rise may be the lower transaction costs (commission rates) applied in London compared to that in Paris or New York (Faith 1985: 51). Seligman (1961: 239) argues that because imports were restricted in England and France, although exports were authorized within limits, the art market became mostly a national affair in these countries and augmented the importance of New York as an international art market. In Seligman's (1961) view, fears of inflation and currency devaluation drove prices up, as local collectors competed to acquire artworks. *The Economist* stresses the price rise for Old Masters compared to the decline in the fashion of British portraits.[26]

Price increases in this period may also reflect changes in the way sales were conducted or sales of important collections. Before World War II, sales were essentially conducted by a few dealers, with auction houses playing a more limited role. Important dealers had offices in several major cities, such as Paris, London, and New York, whereas auction houses acted mostly locally. This changed after the war, when auction houses gradually obtained a more central position in the art market to eventually become leaders of the international market during the 1960s (Cooper 1985: 9, 95). In 1956, in a context of stiff competition with a dealer, Sotheby's (London), for the first time, accepted setting a guaranteed price for auctioning a Poussin (Faith 1985: 53). The years 1957 and 1958 were marked by four exceptional sales in terms of revenues (sales of the Biddle, William Weinberg, Lucy, and Goldschmidt collections). These and other auctions still signaled the importance of London as a place to sell exceptional pieces (Watson 1992: 317). The art index experienced a fall to a low of 176 in 1964, only to recover and reach 338 in 1969 (Figure 1). A reason for the decline in 1964 was because an investigative journalist discovered and exposed an active bidding ring (Faith 1985: 137), which in all

[26] See "Any Old Master?" *The Economist*, July 30, 1955, pp. 370–371.

likelihood temporarily reduced the faith in the auction system. Additionally, starting in 1964, the British pound suffered from speculative attacks, leading to its devaluation in November 1967 (Bordo, MacDonald, and Oliver 2009). The sharp reduction in value might have led to an increase in foreign demand for artworks sold in London. Faith (1985: 141) presents this devaluation as "a crucial event in determining attitudes towards art-as-investment" because, according to him, prices reacted considerably positively to the devaluation. The important sale in 1965 of part of Sir Francis' collection for a total GBP 1,170,529, which established a new record for Britain, may also have reversed the decline to an increasing price trend (Watson 1992: 331). The 1960s were characterized by Sotheby's willingness to popularize the appeal of artworks to a broader public (Burnham 1975, Cooper 1985). This change in strategy was the logical consequence of a simple statistic: 60% of artworks were sold for less than GBP 100. The number of buyers who could afford this sum was large; thus, it made sense to try to convince them to collect. Therefore, Sotheby's gradually gave more importance to the GBP 100 lots (Burnham 1975: 193–194). Furthermore, part of the 1960s boom may in fact have been induced by the exploitation of a tax loophole in the United Kingdom at the time: For the assessment of death duty, artworks deemed of museum quality were not considered to compute the marginal tax rate (Faith 1985: 141). Thus, for the rich, investing in top art would substantially lower inheritance taxes. As for *The Economist,* the price in this period followed the devaluation of the pound and the desire to invest in alternative investments.[27] The negative price shock in 1970 could be explained by the closing of the inheritance tax loophole[28]

[27] See "Arts Brief. The Market Goes Boom," *The Economist,* October 28, 1972, p. 104.

[28] Roy Jenkins, the Chancellor of the Exchequer, stated, "At present, exempt works of art are left out of account when the estate is assessed, and if they are later sold they are charged at the rate already calculated on the general estate. This rate in some cases is very much lower than the rate that would apply if the works of art had been included in the general estate. In an extreme case, a substantial purchase, shortly before death and with a view to its subsequent sale, can be a major means of avoidance. In future, qualifying works of art will remain exempt if retained in the beneficiary's possession; but the exemption allowed for any work of art will be cancelled if it is

and the major decline of the equity markets in Wall Street (and to a lesser extent, those in London). The year 1970 saw an art market decline, and numerous highly publicized buy-ins (Faith 1985: 145) reflected the limited appetite for works of art. Despite the sharp fall of the index in 1970, it recovered rapidly to reach a new art price peak in 1973 (with an index value of 464) (see Figure 1). The movement of our art index is in line with Faith's observation (1985: 169): "the first three years of the decade saw an unparalleled boom in art," which is considered to be mainly driven by European paintings (and Chinese ceramics). In this period, Japanese collectors started buying on the art auction market, and they did so extravagantly owing to the strength of their currency (Burnham 1975: 203). According to Bernier (1977: 332), Japanese collectors bought 80% of the lots sold in an impressionist sale held at Christie's at the end of March 1973. From the early 1970s, the first art investment funds were created (e.g., Artemis in 1970 and Modarco in 1971). These actors were backed by bankers, Baron L. Lambert and E. de Rothschild in the former case, and two Swiss banks in the latter.[29] Art investment funds had existed before, with the famous *La Peau de l'Ours* active in France at the beginning of the 20th century; however, the difference from the new art funds was the scale and the means that became available to buy art.[30]

4.6 Post-Bretton Woods Era (1974–2016)

The demise of the Bretton Woods system was characterized by a return to floating currencies. The art market experienced a dramatic drop at the beginning of the period, falling from 464 in 1973 to

sold within three years of the death. If it is sold later than that, the rate of duty on it will be calculated by adding the proceeds of sale to the general estate plus the value of other works of art sold in the three years after the death. This will in no way make more difficult the position of a family which wishes to maintain intact an outstanding collection. But the pursuit of art for loophole's sake will become less worthwhile."

[29] See "Se laisser tenter par les actions d'Artemis: un mariage exceptionnel entre des experts en art et des hommes d'affaires," *Le Soir*, November 30, 1990; Art People, *The New York Times*, July 1, 1977.

[30] According to contemporaneous actors, such as Burnham (1975), Modarco intended to play a major role and sustain the art market itself.

merely 283 in 1977 (Figure 1) (with a short-lived recovery),[31] only to drop further, ending at 243 in 1982. Faith (1985: 169, 174) argues that the art-price decline was triggered by the first oil shock of 1973, which significantly weighed on prices for several years (1974–1975). This observation is confirmed by our price index (Figure 1). Burnham (1975: 208) also mentions the dramatic effect of the oil crisis on art. The author argues that the crisis affected major art collectors as well as buyers of more modestly priced art. Bernier (1977: 337) suggests that sellers continued to revise their reserve prices downward—the minimum price below which a bid is not accepted; thus, the painting is not sold. Even so, a substantial proportion of auctioned artworks (close to 50%) were "bought in." In view of their diminishing revenues, Sotheby's and Christie's decided to increase the transaction costs and introduced a buyer's premium in the fall of 1975.[32] The slump in prices affected almost all artistic movements—even impressionism, which had, up to then, been viewed as immune to downward price corrections.[33,34] The main reason for the art price decreases was a high-interest-rate period reflecting a poor economic environment, culminating in the 1980–1982 recession (Watson 1992: 370).

The 1980s were marked by a strong rise in prices. In only eight years, from 1982 to 1990, the index experienced almost a fourfold increase, moving from a low of 243 in 1982 to 855 in 1990. The massive rise in prices on the art market coincided with a strong boom in the world's equity markets (Watson

[31] Attributed by *The Economist* to inflation ("You Can't Go Wrong with Old Masters," *The Economist*, July 28, 1979, p. 26).

[32] See "Auction Houses Profits Down, Charges Up," *The Economist*, June 7, 1975, pp. 49–50.

[33] See "Unimpressionists," *The Economist*, June 5, 1976, p. 95.

[34] A major sale held by Christie's New York in May 1981 (the Cristallina auction) ended in disaster (with many artworks attracting no bids at all and even more failing to reach their reserve prices). Several financial reasons have been suggested to explain the lackluster performance of the auction, but the trial that followed the auction highlighted the fact that Christie's had not followed its own policy of not agreeing to reserve prices higher than presale estimates. Cristallina S. A. V. Christie, Manson & Woods International, Inc., 117 A.D.2d 284, N.Y. Supreme Court, App. Div. (1986).

1992: 382), and the mounting inflation could have contributed to investing in art as an inflation hedge.[35] Additionally, auction houses facilitated buying art by offering financial services (e.g., Sotheby's in 1988, Horowitz 2011, Graddy and Hamilton 2017). In this decade, new records in prices for paintings were broken nine times (Spaenjers, Goetzmann, and Mamonova 2015; Renneboog 2019). To place this in perspective, the first new record of the decade, established in 1980, replaced one dating from 1970, and the record from 1990 would last until 2002. (Post-)Impressionist paintings, and more specifically, paintings by Vincent van Gogh, broke three of these records. Hiraki et al. (2009) demonstrate the influence played by Japanese collectors on international prices and their central role in the development of a bubble for impressionist and post-impressionist art.

The spectacular increase in prices during the 1980s is captured by our index (Figures 1 and 3), which shows the bursting of the art bubble in 1990–1991 and the subsequent continued price fall to a low of 439 in 1998. Hook (2014: 330) points to high interest rates prevailing at the time to explain the dismal art performance. This downward episode was followed by a strong increase in the index, which culminated in a new record high art index level of 839 in 2007. Art prices then fell sharply, reaching an index value of 618 in 2009, and experienced a short-lived increase in 2010 (672), only to drop further toward a low of 520 in 2015. The financial crisis and subsequent recession (often called the Great Recession) explain part of the decline in prices, although some stress the resilience of art markets during this crisis as the art market decline was more modest than the fall of the equity markets (Hook 2014: 330). According to Thompson (2017: 198), the decline in art prices occurred with a 5–7-month lag

[35] See "Top and Bottom of the Art Market," *The Economist*, October 28, 1989, p. 125.

behind the equity market crash owing to auction house guarantees that had been set before the crisis.[36] The same author suggests that prices for high-quality, contemporary works declined by 10%–15% between 2007 and 2009, the middle third declined by 40%, and the bottom end by 50%. Our data confirm this observation; we also find that the high-end market (highest price quartile of our sample) declines less during the Great Recession than the low-end market (bottom price quartile). Numerous galleries were in fact forced to close (Horowitz 2011, Thompson 2017). Nevertheless, Russian, Chinese, and Indian art experienced a strong rise in sales and prices in the United Kingdom between 2001 and 2006 (Renneboog and Spaenjers 2010, Horowitz 2011). The recent period also witnessed strong price increases in emerging markets, which are (by definition) not captured by our index. During the 21st century, the British market gradually lost ground to the Chinese market; western auction houses opened branches in Hong Kong and subsequently on mainland China. In 2010, for the first time, China became the second-largest player in the art world. Since then, the second-place position has alternated between China and the United Kingdom (McAndrew 2019), although Chinese art market growth may have to be discounted. This is because it has suffered from fake bidding and insolvent bidders not honoring their bids. For the high-end market, New York has surpassed London; auction records are broken in New York at double the rate than in London (Thompson 2017). The low prices and stabilized volume numbers observed at the end of our sample are consistent with the observations from the two main auction houses: Both Sotheby's and Christie's reported a decline in sales and prices in 2015 (Thompson 2017: 61).

[36] Goetzmann, Renneboog, and Spaenjers (2011) document that, in general, the art market lags the equity market by approximately half a year. They find a positive correlation with equity capital gains but not with dividend payouts.

5. Art Returns and Crises

The real price index for the British art market enables us to calculate its return and risk[37]. Table 1 lists the hedonic coefficients of year dummies, the price indices, returns, and volume changes from 1908 onwards. Table 2 provides an overview showing that the arithmetic annual real return over the whole sample period of 110 years amounts to 3.6% in Panel A (equivalent to an annual nominal return of 7.6%) and risk to 20.1% (Panel B). The positive pre-World War I returns are wiped out in the war period when returns turn negative (Panel A). During the interbellum, real returns barely exceeded inflation (Sbrancia 2011). Perhaps unexpectedly, art returns during World War II were high (with modest volatility) and, hence, seem to have been an inflation hedge (Panel D). Oosterlinck (2017) shows that during World War II, when gold, foreign securities, and foreign currencies were unavailable on a legal market in occupied France, artworks outperformed other investment opportunities, including equities, bonds, and black-market gold and foreign currencies. In wartime, especially in occupied countries, investment opportunities were sharply restricted, and investors needed to look beyond traditional financial markets. Illegal activities and the risk of being forced to flee the country increased the appeal of discreet assets, such as art. Returns continued their strong momentum during the Bretton Woods period (with an arithmetic annual real return of 9.1%) but disappointed with an annual real average of merely 1.2% in the post-Bretton Woods period (after 1974). The latter period is characterized by two large bubbles that burst in 1991 and 2008, following major stock market crises within the year (Panel D). In terms of volatility, our results show sharp changes in function of the period considered. The relatively low returns

[37] The arithmetic return is calculated as $\mathrm{AR} = \frac{1}{n}\sum_{t=1}^{n} r_t^*$, and the geometric return is calculated as $\mathrm{GR} = (\prod_{t=1}^{n} r_t^*)^{\frac{1}{n}}$.

observed for the pre-World War I period coincided with a low level of volatility. The periods running from World War I to World War II are characterized by a high level of volatility. During World War I, not only was risk high, returns were dramatically low. During the interwar period and World War II, the risk-return tradeoff significantly improved but, it was especially the Bretton Wood period that proved superior combining a high return with low volatility. Interestingly, the volatility today is at a relatively low level, close to the one observed during the pre-World War I period. Both periods are known to be periods of globalization, and our result suggest that in a globalized world, returns on the art market exhibit lower volatility.

Table 2 also provides the real stock returns by period and the growth in real GDP and real consumption per capita. During World War I, art investments outperformed stock returns in terms of the rate of returns (Panels A and D) and the Sharpe Ratio (Panel C). In summary, art markets outperformed equity markets in war times, whereas the inverse occurred in periods of financial distress. World War II created a strong boom in the UK art market, in line with the French market.

[Insert Tables 1 and 2 about here]

To investigate the performance of art in crises, we classify the UK main crises over the past century into financial and economic, and geo-political (or war) crises, an overview of which is provided in Table 3. The economic crises (almost always coinciding with financial declines in the United Kingdom) are defined as the occurrence of two successive quarters of negative economic growth (measured by seasonally adjusted quarter-on-quarter real GDP). We observe eight economic and financial crises in the timeframe of our paper: post-World War I recession (1919–1921), Great Depression (1930–1931), 1956 recession (1956Q2–1956Q3), mid-1970s recessions (1973Q3–1974Q1; 1975Q2–1975Q3), early 1980s recession (1980Q1–1981Q1), early 1990s recession (1990Q3–1991Q3), and the Great Recession

(2008Q2–2009Q2). Additionally, we consider the systemic crises identified by Schularick and Taylor (2012) as events during which a country's banking sector experiences the following: bank runs, sharp increases in default rates accompanied by large losses of capital that result in public interventions, bankruptcy, or forced mergers of financial institutions. There are three systemic shocks (1974, 1991, and 2007), which largely overlap with the economic and financial crises. Therefore, we focus on the economic and financial crises in Subsection 5.1. The other important type of crises comprises the war periods, including World War I (1914Q3–1918Q4) and World War II (1939Q3–1945Q3).[38]

[Insert Table 3 about here]

5.1 Art in Times of Economic and Financial Crises

We start with the economic and financial crises and run regressions relating real art returns and changes in sales volumes to crisis identifiers while controlling for macroeconomic variables (i.e., changes in GDP, equity market returns, and changes in income inequality). To determine the impact of crises more precisely, we use a semiannual series in this subsection. In Panel A of Table 4, we observe that the art returns are sensitive to economic and financial crises as they fall, on average, by 14.8% in real terms per semester (column (1)), by 13.6% when controlling for lagged equity returns (column (2)), and by 15.6% for income inequality (column (3)). After further controlling for changes of GDP, the negative impact of economic and financial crises on art returns turns smaller, approximately 10.8% per semester (or 21.8% annually; column (4)). In any case, the bottom line is that economic and financial crises strongly affect the art market, even more than the equity market. Columns (5)–(8) in Panel A of

[38] To investigate the difference of art performance in early stages and later stages of the war, we make the following distinctions: early war periods (1914Q3-1915Q4; 1939Q3-1941Q1) and later war periods (1916Q1-1918Q4; 1941Q2-1945Q3).

Table 4 shows the impact of crises on volume changes. Unlike the case of real art returns, the negative impact of economic and financial crises on transaction volumes is not statistically significant. During these crises, the price level of art usually goes down, as buyers may experience negative wealth shocks and suffer from reduced purchasing power. Likewise, sellers may be forced to sell art in bad times for liquidity reasons and may be forced to accept lower prices. Auction houses try to keep maximizing the number of items offered for auction to remain profitable. Major auction lots are often locked up three to six months before the sale (Thompson 2014: 163). Consequently, volumes may react with a lag to bad news.

We also investigate the impact of economic and financial crises on subsamples by subperiod, sales liquidity, price level, and artist's nationality in Panel B of Table 4. Splitting the sample into subsample periods 1907–1960 and 1961–2016 in columns (1)–(2) in Panel B, we note that the impact of financial crises on art has a strong negative impact on returns and that this impact is somewhat higher in the former period. This observation may reflect the fact that in the more recent period, it became common for auction houses to propose guarantees. As the guarantees are typically set three to six months before the sale, when a downturn occurs, guarantors have no time to adapt; thus, they often end up paying guarantees well above the ongoing prices (Thompson 2014: 163). Subsequently, we classify transactions based on the sales liquidity of the artist's oeuvre; liquid (illiquid) sales refer to paintings of which the artist on average has five or more (less than five) auctioned transactions per year. We document in Columns (3)–(4) of Panel B that the negative impact of economic and financial crises is more pronounced for non-liquid sales (e.g., a decline of approximately 13.5% per semester; column (4)) than for liquid ones (a decline of approximately 8.7%; column (3)), but the effects are not statistically

significant.[39] In Columns (5)–(6) of Panel B, we consider how economic and financial crises affect art returns in high-end and low-end markets, stratified by the 90th and 10th price percentiles. The results show that the high-end markets (top 10% in column (5)) experience larger declines than the low-end markets (bottom 10% in column (6)). This may not come as a surprise, as the high-end market surges during boom periods, although it is not crisis-resilient. Columns (7)–(10) in Panel B present the impact of crises on subsamples created by the artists' nationalities. We document that paintings by local (British) artists decline less than those by foreign ones (from the Low Countries/Belgium/the Netherlands, France, Italy and other countries—not tabulated). Therefore, one may conjecture that in times of crises, buyers want to focus on their local market to be able to resell the works, should international markets be closed owing to foreign exchange restrictions.[40]

[Insert Table 4 about here]

5.2 Art in Times of War

The story of art during war times seems more complicated than that during economic and financial crises. As mentioned in the literature review, the art market boomed in occupied countries during World War II but offered contrasting experiences during World War I, with a boom in Germany and a crash in

[39] In the literature on liquidity portfolio management during crises, there is a trade-off between selling liquid assets to minimize contemporary trading costs and selling illiquid assets to keep a "liquidity cushion" (e.g., Scholes 2000, Duffie and Ziegler 2003). Driessen and Xing (2017) show that hedge funds sold more liquid than illiquid stocks at the peak of the 2008 financial crisis, and they repurchased numerous liquid stocks and continued to sell illiquid ones when the crisis was attenuated.

[40] We also report the detailed art returns of subsamples in each economic and financial crisis in Online Appendix VIII. We show that art movements have different crisis-sensitivities (notably, not all art schools were operational when different types of crises emerged). Crises affect earlier art movements—the Old Masters (*Medieval and Renaissance*; *Baroque*; *Rococo*), (early) 18th century art (*Neoclassicism*; *Romanticism*; *Realism*), and *Impressionism and Symbolism*, but the effect is smaller on the combination of art movements, which we label as Modernism (*Fauvism and Expressionism*; *Cubism, Futurism, and Constructivism*; *Dada and Surrealism*) and on an aggregate movement that includes *Abstract Expressionism, Pop, Minimalism and Contemporary*.

France. In Table 4, the results show that art does *not* experience a significantly large decline in war times, whereas it does in economic and financial crises as discussed in Subsection 5.1. When we separate the wars into early war and later war periods, we find that the art market experienced marked increases in terms of both returns and volume in the late war period. In the early war period, volume shrank. From the subsample analyses, we learn that liquid sales (column (3)) and the high-end price segment (top 10% in column (5)) experienced larger increase than the non-liquid sales (column (4)) and the low-end price segment (bottom 10% in column (6)) during the late war period. The low-end price segment experienced a 12.8% (bi-annual) decline over the early stage of the war and continued to have negative returns in the late stage of the war (-14.5% biannually). For the artist nationality subsample, in line with the above findings for the economic and financial crises, British artists seem more resilient to war crises in the early stage of the war (a modest and not statistically significant decline of 4.3%), compared to more than 30% decline in returns for foreign artists sold in UK market. At the late stage of the war, the British artists also experienced larger return increases compared to those of foreign artists.

We further investigate art returns and volume changes by year for World War I and the post-World War I recession period (Panel A of Table 5) and World War II (Panel B). We consider the returns of several subsamples created based on an oeuvre's liquidity, price quantiles, a classification based on artist's nationality, and painting size. At the beginning of World War I, the art market experienced a large decline by -24.4% in 1914 and -32.4% in 1915; further, the transaction volumes went in a similar direction with a decline by -36.1% in 1914 and -43.0% in 1915. The market recovered relatively fast in 1916 with a return of 20.6% and a volume increase of 99.1%. In 1917, the market remained stable with a return of 19.2% and a volume increase of 27.1%, but was followed by a decline in 1918 when the war was close to its end. The market remained depressed during the post-World War I recession period. In

Panel B (World War II), the art market declined by -14.3% in 1939 and -13.6% in 1940, but recovered in 1941 and remained positive till the end of the war in 1945, which is in line with the French art market in those years (Oosterlinck 2017). Thus, the British experience tends to indicate that the onsets of the wars were perceived negatively, but that the market subsequently experienced a strong upward movement, possibly at a point when it became clear that a victory by the enemy was unlikely.

The subsamples, based on the liquidity of the artists' oeuvre, show no consistent pattern during World War I. However, during World War II, the returns of less-liquid paintings declined more than those of liquid paintings, but recovered in the later stages of the war. In relation to market segments based on price levels, the high-end markets declined substantially more at the start of World War I than the low-end markets (e.g., returns of the top 10% priced paintings declined by -30.3%, whereas the bottom 10% declined by merely -7.8% in 1914). At the outbreak of World War II, the returns of the high-end market were lower than those of the low-end market; however, over the course of the war, the high-end market generated positive returns.

Oosterlinck (2017) proposes the concept of discretion as the ability to store a large amount of value in small and easily transportable goods. The discretion offered by artworks makes art a wartime investment as prices boom with the surge in demand for portable and easy-to-hide (discreet) assets, such as artworks. In Table 5, we demonstrate that large paintings declined more or increased less in value than small paintings at the beginnings of World War I and World War II, which can be explained by the portability of small paintings by refugees.[41] Once the outcome of World War II became predictable (end of 1942), the inverse relation becomes evident.

In Table 6, we further examine how the pricing of a painting's optimal size evolves over time

[41] The painting is classified as a small (large) painting if the size of the painting is below (above) the median size.

through the measurement coefficients (*Height, Height Squared, Width, Width Squared, Size,* and *Size Squared*) obtained from hedonic price regressions.[42] The coefficients of height and width are positive, but those of the squared terms are negative. This indicates that prices increase with size, up to the point that the work becomes too large to sell easily and then declines in value. We can derive the optimal height, width, and size from the coefficients of the size term and size squared term.[43] Table 6 shows that the optimal width, height, and size are lower during the war periods (Panels A–D). Panel D shows that the painting's optimal size during World War I was lower than during the interbellum (when size increased by 8.3%) and then declined again by 22.8% during World War II (the smallest optimal size measured over the entire century).

[Insert Tables 5 and 6 about here]

5.3 Art and Portfolio Optimization

We investigate the role of art in optimal asset portfolios during crisis and non-crisis periods, but first perform alpha regressions whereby we regress excess art returns on the crises periods while controlling for excess equity and excess bond returns (Table 7). We find that there is no significant alpha in the regressions that cannot be explained by excess equity and bond returns (column (1) of Table 7). When we control for the economic and financial crises and the war periods, the alpha is positive and

[42] The coefficients of the measurements result from several hedonic models (see Subsection 3.2.1). For the data in Panel A, we include *Height* and *Height Squared* in the hedonic regression; for Panel B, we include *Width* and *Width Squared*; for Panel C, we include *Height*, *Height Squared*, *Width* and *Width Squared*. Finally, for Panel D, we include *Size* and *Size Squared* in a hedonic regression.

[43] In the hedonic pricing regressions, we exclude observations with measurements below the 1st percentile or above the 99th percentile. The optimal size in terms of pricing can be calculated as -0.5 ×coefficient of measurement divided by coefficient of measurement squared term, which is the maximum point in the quadratic function when the squared term is negative.

significant (column (6)), which ensures that art can enter the optimal portfolio under the Capital Asset Pricing Model (CAPM) assumption. Consistent with Table 4, we find positive coefficient for the late war period dummy and negative coefficient for the economic and financial crises dummy.

[Insert Table 7 about here]

To test the role of art in the optimization process of portfolio allocation comprising traditional financial assets, namely, equity, bonds, gold, and real estate, we perform a mean-variance analysis by including and excluding art in optimal portfolios in Table 8, where Panel A covers the period of 1908–2016, Panel B the non-crisis period, Panel C the economic and financial crises and Panel D the war times. For the whole sample window of more than a century, the inclusion of art in the investment universe generates portfolio Sharpe ratios that outperform those of portfolios based on investments excluding art. For example, the optimal Sharpe ratio is 0.23 of a portfolio that includes equity and bonds, and after adding paintings in this portfolio, the Sharpe ratio increases to 0.25. When other assets, treasury bills, gold and real estate, are gradually added to the portfolio's investment universe, the portfolio including paintings always has a higher Sharpe ratio than one without. When we consider all six asset classes of the investment pool (equities, bonds, treasury bills, gold, real estate, and art), the optimal portfolio weights are 39.7% for real estate, 36.3% for equities, 10.3% for gold, and 5.6% for bonds, with art entering the portfolio with a weight of 8.1%. The Sharpe ratio of this optimal portfolio is 0.27. In Panel E of Table 8, we show that art returns are positively (but modestly) correlated with those of equities (0.15) and real estate (0.12); we observe correlations close to 0 with gold (0.01), treasury bills (0.05) and government bonds (-0.09). The link between stock markets and the art market has been observed previously (Goetzmann, 1993). The correlation with the housing market might reflect the common dual nature of both goods: consumption and investment. They may therefore be subject to

similar dynamics.

Panels B, C and D of Table 8 present the optimal portfolio allocation results of financial assets and paintings by sub-period. During the non-crisis period (Panel B), the optimal portfolio comprises 39.8% of equities, 37.3% real estate, 10.4% of bonds, 4.4% of gold, and 8.1% of art, and reaches a high Sharpe Ratio of 0.37. However, paintings disappear from the optimal portfolio in the financial crisis periods (Panel C), which is explained by the negative returns that investing in art generates over these periods. During war periods (Panel D), art investments still represent a substantial part in the optimal portfolio, 7.1%, unsurprisingly along with gold and real estate.

[Insert Table 8 about here]

6. Conclusion

In this study, we provided a detailed overview of the evolution of the British art market over more than a century, covering the pre-war period (1907–1913), World War I (1914–1918), the interwar period and Great Depression (1919–1939), World War II (1939–1945), the Bretton Woods period (1944–1973), and the post-Bretton Woods era (1974–2016). To do so, we digitalized historical auction archives to construct art price indices from the early 20th century onwards. Since 1907, the British art price index expanded more than sevenfold in real terms. Over the whole sample period of 110 years, the arithmetic annual real return amounts to 3.6% and risk to 20.1%. This strong appreciation is a modern phenomenon, as the index fell to below its original value up to 1958. However, this does not mean that the market did not experience major changes prior to 1960, as shown by our analysis of the impact of wars and crises on the market value of paintings.

We further classified crises into economic and financial crises and geo-political (war) crises, and

analyzed the performance of art during each crisis. Art returns plummeted at the onset of wars but turned positive in the later years of the war periods and then outperformed equities. This suggests that art could serve as a hedge against political uncertainty. During wartimes, investment opportunities are restricted, and under such circumstances, art can be an appealing alternative investment. Our results also suggest that returns are affected by perceptions of the outcome of a war. The onset of war is characterized by negative returns on art; however, with the war end in sight, the price rally may be spectacular. We document that when the market was picking up in 1916–1917, higher returns were realized on more liquid artworks. During both world wars, smaller paintings obtained higher returns, possibly because they are more transportable.

Art is sensitive to economic and financial crises, with the largest slumps occurring in the Post-WWI recession (1919–1921), the Great Depression (1930–1931), the (post) oil crisis (1974–1975), the recessions of the early 1980s (1980–1981) and the early 1990s (1990–1991), and the Great Recession (2008–2009). By far the largest declines in art returns occurred in 1921 (-40.5%) during the Post-WWI recession, in 1931 during the Great Depression (-62.9%), and in 1991 (-37.3%) when the largest art market bubble in art history burst. Recessions have a bigger negative impact on art returns of a non-liquid artistic oeuvre but affect both high and low ends of the art market in similar ways. During financial crises and economic recessions, the art market performs poorly: Returns are then even lower than those for equity, suggesting that artworks hardly qualify as safe-haven investments. We find no significant relationship between economic cycles and the number of artworks offered on the auction market. Although higher prices may attract more volume, volume does not significantly collapse in recessions; the reason may be that part of the sales may be forced (as a result of the four Ds: death, debt, divorce and disaster of which the latter three may be correlated to recessions).

This paper also investigates the role of art as an investment by assessing the optimal portfolio allocations across non-crisis periods, economic and financial crises, and war times. We find that investing in art optimizes the risk-return tradeoff in non-crisis periods, but also in times of high uncertainly such as political crises (wars).

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Figure 1. Real Price Indices: 1908–2016

This figure presents real price indices of British Art Markets from 1908 to 2016. The price indices are constructed using a hedonic price regression. Here, the "adjusted" index stands for the adjustment for Jensen's inequality (as discussed in Section 3 (Data and Methodology)). As the historical data source *Art Prices Current* started in November 1907, there are only 761 auction observations available in total in 1907. To avoid sample bias in 1907, we use the auction records from 1908 and the years onwards.

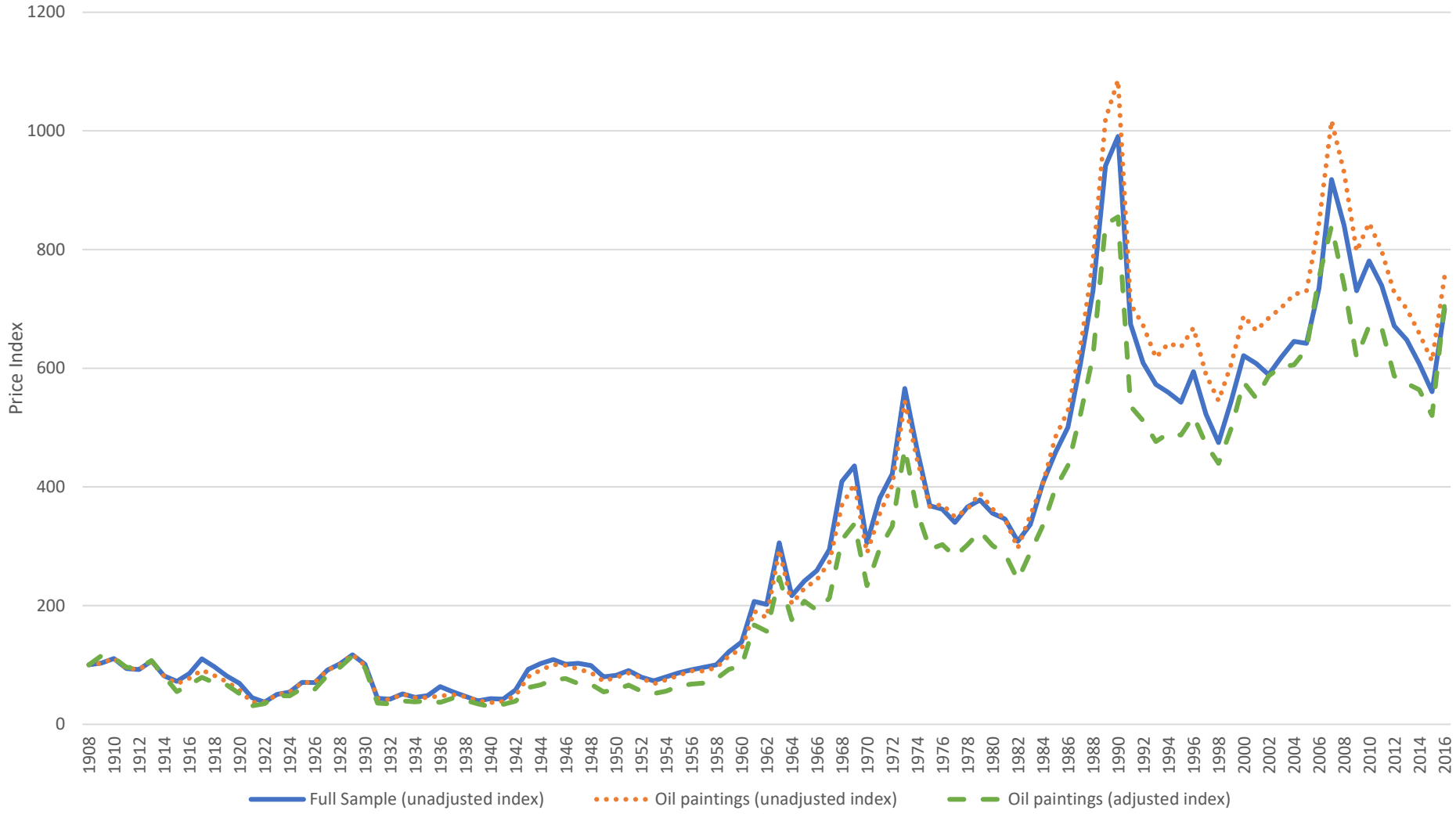


Figure 2. Real Price Index and Volume: 1908–1960

This figure presents the real price index and volume of British Art Markets from 1908 to 1960. The left axis presents the price index level, and the right axis presents the number of sales. The price index is constructed using a hedonic price regression (as discussed in Section 3 (Data and Methodology)). As the historical data source *Art Prices Current* started the records in November 1907, there are only 761 auction observations available in total in 1907. To avoid sample bias in 1907, we use the auction records from 1908 and the years onwards.

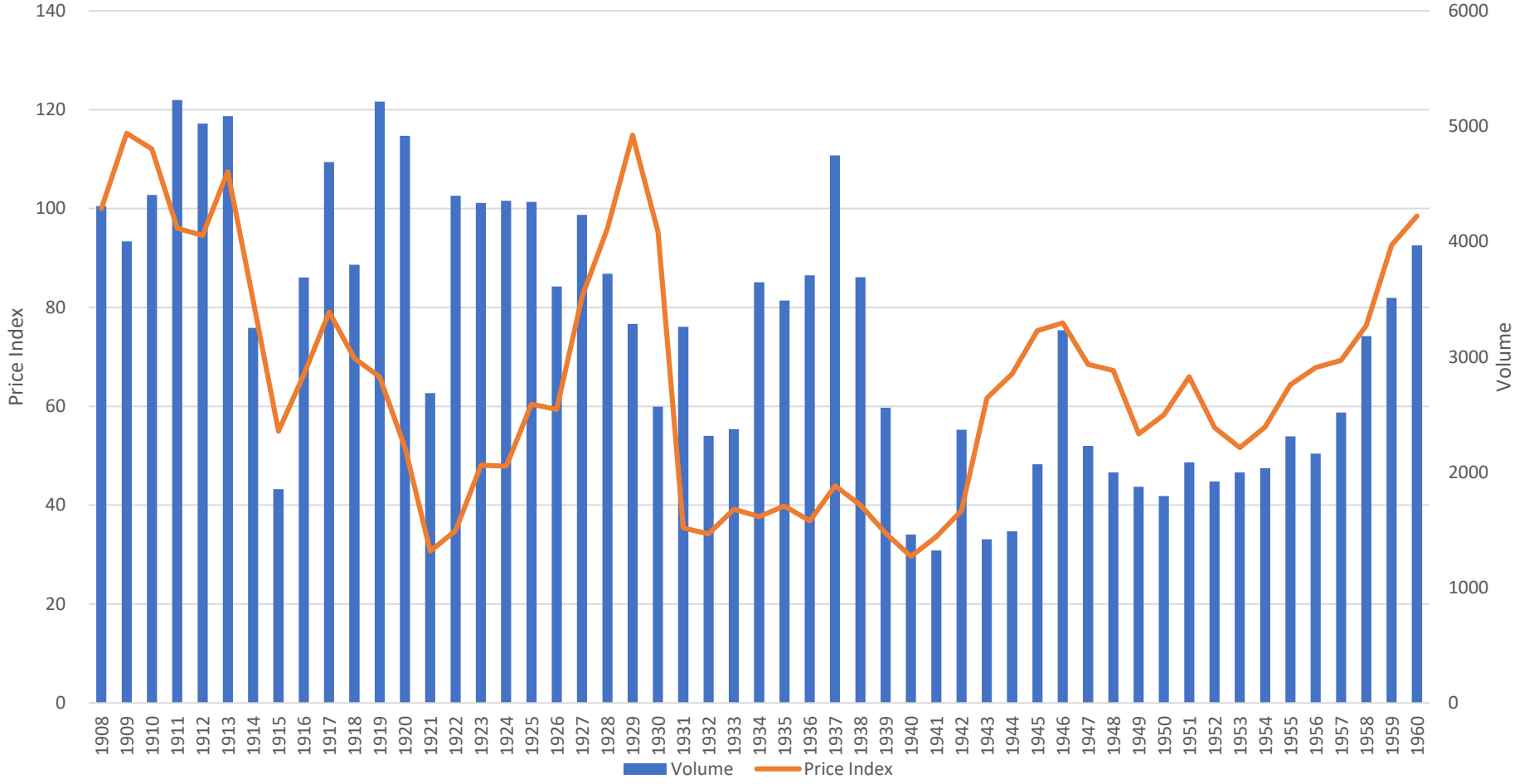


Figure 3. Real Price Index and Volume: 1961–2016

This figure presents the real price index and volume of British Art Markets from 1961 to 2015. The left axis presents the price index level, and the right axis presents the number of sales. The price index is constructed using a hedonic price regression (as discussed in Section 3 (Data and Methodology)).

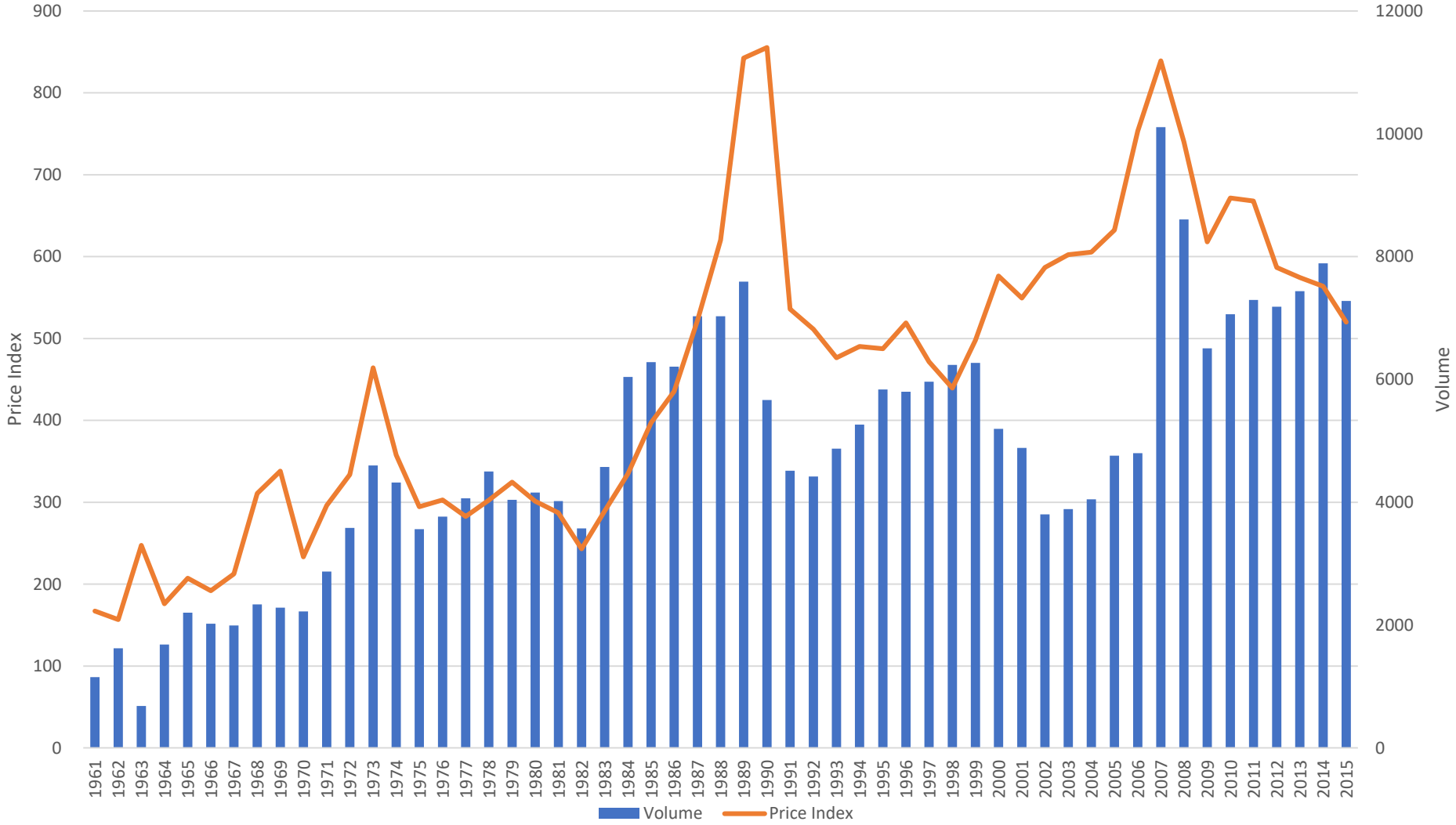


Table 1. Art Price Indices, Returns, and Volume Changes

This table presents the art price indices and real returns (oil paintings) for the baseline hedonic regression model. For each year, we report the nominal and real price indices and returns adjusted for changes in price dispersion over time (Π* and r*) (see methodology Subsection 3.2.1), as well as the (changes in) sales volume.

Year	Nominal Index	Nominal Return	Real Index	Real Return	Volume	Volume Change
1908	100		100		4308	
1909	114	14.17%	115	15.24%	4002	-7.10%
1910	113	-1.34%	112	-2.78%	4404	10.04%
1911	97	-13.62%	96	-14.31%	5227	18.69%
1912	96	-0.87%	95	-1.50%	5023	-3.90%
1913	113	16.86%	108	13.70%	5087	1.27%
1914	86	-24.00%	81	-24.39%	3252	-36.07%
1915	60	-30.38%	55	-32.36%	1853	-43.02%
1916	79	32.20%	66	20.62%	3689	99.08%
1917	110	39.53%	79	19.22%	4688	27.08%
1918	121	9.96%	70	-11.81%	3798	-18.98%
1919	139	14.75%	66	-5.43%	5214	37.28%
1920	120	-13.48%	52	-21.80%	4917	-5.70%
1921	83	-30.63%	31	-40.46%	2685	-45.39%
1922	86	3.28%	35	13.43%	4396	63.72%
1923	102	19.01%	48	38.06%	4335	-1.39%
1924	96	-6.17%	48	-0.46%	4353	0.42%
1925	120	25.09%	60	26.25%	4344	-0.21%
1926	118	-1.53%	59	-1.76%	3609	-16.92%
1927	162	36.93%	82	38.50%	4232	17.26%
1928	184	13.29%	96	16.67%	3721	-12.07%
1929	219	19.10%	115	19.75%	3285	-11.72%
1930	181	-17.28%	95	-17.06%	2569	-21.80%
1931	67	-62.98%	35	-62.87%	3260	26.90%
1932	62	-7.35%	34	-3.31%	2315	-28.99%
1933	69	10.69%	39	14.52%	2372	2.46%
1934	65	-5.58%	38	-3.76%	3647	53.75%
1935	68	5.38%	40	5.61%	3487	-4.39%
1936	64	-6.79%	37	-7.58%	3706	6.28%
1937	76	19.46%	44	19.28%	4746	28.06%
1938	72	-5.85%	40	-8.81%	3691	-22.23%
1939	63	-12.48%	34	-14.28%	2559	-30.67%
1940	56	-10.63%	30	-13.57%	1460	-42.95%
1941	74	31.51%	34	13.23%	1322	-9.45%
1942	94	27.01%	39	15.76%	2367	79.05%
1943	157	68.03%	62	58.64%	1417	-40.14%
1944	175	11.35%	67	7.97%	1486	4.87%
1945	203	15.87%	75	13.11%	2069	39.23%
1946	213	4.99%	77	2.08%	3231	56.16%
1947	195	-8.32%	68	-10.93%	2228	-31.04%
1948	205	5.10%	67	-1.80%	1997	-10.37%
1949	179	-12.74%	54	-19.08%	1874	-6.16%
1950	197	10.19%	58	7.18%	1794	-4.27%
1951	232	17.34%	66	13.16%	2086	16.28%
1952	213	-8.16%	56	-15.63%	1919	-8.01%
1953	218	2.68%	52	-7.30%	1998	4.12%
1954	244	11.88%	56	8.12%	2035	1.85%
1955	288	17.84%	64	15.31%	2310	13.51%
1956	319	10.89%	68	5.41%	2160	-6.49%
1957	342	7.05%	69	2.16%	2517	16.53%
1958	391	14.34%	76	10.17%	3181	26.38%
1959	488	24.79%	93	21.35%	3512	10.41%
1960	522	7.08%	98	6.30%	3966	12.93%
1962	866	-3.40%	157	-6.24%	1624	40.85%
1963	1424	64.47%	247	57.76%	685	-57.82%

Year	Nominal Index	Nominal Return	Real Index	Real Return	Volume	Volume Change
1964	1034	-27.38%	176	-28.79%	1685	145.99%
1965	1258	21.61%	207	17.74%	2202	30.68%
1966	1214	-3.44%	192	-7.38%	2023	-8.13%
1967	1398	15.13%	213	10.68%	1993	-1.48%
1968	2087	49.28%	311	46.17%	2335	17.16%
1969	2363	13.21%	338	8.80%	2284	-2.18%
1970	1715	-27.42%	233	-30.95%	2223	-2.67%
1971	2319	35.23%	296	26.89%	2874	29.28%
1972	2859	23.29%	334	12.72%	3581	24.60%
1973	4260	48.98%	464	39.10%	4601	28.48%
1974	3588	-15.76%	358	-22.95%	4322	-6.06%
1975	3421	-4.66%	295	-17.63%	3563	-17.56%
1976	4314	26.09%	303	2.73%	3765	5.67%
1977	4654	7.88%	283	-6.64%	4063	7.92%
1978	5727	23.07%	303	7.03%	4500	10.76%
1979	6602	15.28%	325	7.31%	4039	-10.24%
1980	6828	3.41%	301	-7.18%	4157	2.92%
1981	7492	9.73%	287	-4.70%	4020	-3.30%
1982	7093	-5.32%	243	-15.35%	3574	-11.09%
1983	9124	28.63%	289	19.03%	4576	28.04%
1984	11082	21.45%	335	15.78%	6043	32.06%
1985	13698	23.61%	397	18.58%	6280	3.92%
1986	15767	15.10%	436	9.66%	6207	-1.16%
1987	19521	23.81%	522	19.84%	7029	13.24%
1988	23946	22.67%	620	18.80%	7029	0.00%
1989	33757	40.97%	843	35.84%	7594	8.04%
1990	36055	6.81%	855	1.51%	5664	-25.41%
1991	24158	-33.00%	536	-37.34%	4515	-20.29%
1992	24793	2.63%	512	-4.55%	4420	-2.10%
1993	24082	-2.87%	476	-6.86%	4874	10.27%
1994	25396	5.46%	490	2.88%	5264	8.00%
1995	25748	1.38%	487	-0.55%	5837	10.89%
1996	28157	9.36%	519	6.51%	5802	-0.60%
1997	26198	-6.96%	472	-9.14%	5962	2.76%
1998	24839	-5.19%	439	-6.84%	6238	4.63%
1999	28601	15.15%	498	13.29%	6270	0.51%
2000	33556	17.33%	576	15.77%	5197	-17.11%
2001	32230	-3.95%	549	-4.66%	4885	-6.00%
2002	34874	8.20%	587	6.81%	3803	-22.15%
2003	36254	3.96%	602	2.64%	3890	2.29%
2004	36914	1.82%	605	0.51%	4050	4.11%
2005	39073	5.85%	632	4.43%	4758	17.48%
2006	47507	21.59%	753	19.13%	4800	0.88%
2007	54015	13.70%	839	11.42%	10110	110.63%
2008	48748	-9.75%	740	-11.82%	8605	-14.89%
2009	42157	-13.52%	618	-16.51%	6506	-24.39%
2010	46805	11.03%	672	8.69%	7062	8.55%
2011	48124	2.82%	668	-0.55%	7293	3.27%
2012	44157	-8.24%	587	-12.13%	7186	-1.47%
2013	44471	0.71%	574	-2.11%	7439	3.52%
2014	44756	0.64%	564	-1.83%	7891	6.08%
2015	41876	-6.43%	520	-7.78%	7277	-7.78%
2016	56980	36.07%	707	35.99%	876	

Table 2. Returns and Risks of Art

This table presents real returns and risks of British art and stock markets, GDP per capital growth, and consumption per capita growth by period. Panel A provides the summary of arithmetic and geometric mean of adjusted art real returns, real equity returns, real GDP growth, real consumption growth and inflation. Equity returns are from the UK FTSE All-Share Return Index in Global Financial Data (GFD) (the index uses Bank of England shares exclusively before 1922, the Banker's Magazine Index of All Variable Dividend shares for 1922-1932, the Actuaries General Share index 1932-962 and the All-Share index from 1964). The CPI and Real GDP per capital series are from the Jordà-Schularick-Taylor Macro-history Database. The real consumption per cap. series are from Barro-Ursúa Macroeconomic Data. Panel B lists the volatility of real returns. Calculations of unsmoothed volatility are in Subsection 3.2. Panel C presents the Sharpe Ratio by period. Arithmetic returns are used to calculate the Sharpe Ratio; risk-free rate is UK 3-m. T-Bill Rate from GFD. In Panel D, we show real art real and equity returns, real GDP growth, real consumption growth, and inflation by crisis period.

Panel A: Art Mean Real Returns by Period

Period	Real Art Return	Real Equity Return	Real GDP Growth	Real Consumption Growth	Inflation
Arithmetic Mean Real Return					
1908-1913 (Pre-war)	2.07%	0.31%	2.40%	1.19%	0.82%
1914-1918 (WWI)	-5.74%	-8.78%	1.54%	-3.29%	15.50%
1919-1938 (Interbellum)	0.94%	8.48%	1.16%	2.02%	-0.66%
1939-1945 (WWII)	11.55%	8.61%	1.92%	-1.34%	6.63%
1944-1973 (Bretton Woods)	9.13%	5.24%	1.69%	2.55%	4.63%
1974-2016 (Post-Bretton Woods)	1.22%	10.35%	2.00%	2.11%	5.21%
1908-1945	2.20%	5.07%	1.52%	0.56%	3.10%
1908-1960	2.26%	6.41%	1.53%	1.10%	3.52%
1946-2016	4.34%	8.22%	2.05%	2.25%	5.03%
1961-2016	4.86%	7.82%	2.18%	2.19%	5.16%
1908-2016	3.60%	7.13%	1.87%	1.63%	4.36%
Geometric Mean Real Return					
1908-1913 (Pre-war)	1.46%	0.30%	2.40%	1.18%	0.81%
1914-1918 (WWI)	-8.29%	-9.51%	1.50%	-3.39%	15.14%
1919-1938 (Interbellum)	-2.74%	6.65%	1.03%	1.98%	-0.84%
1939-1945 (WWII)	9.45%	7.54%	1.78%	-1.45%	6.51%
1944-1973 (Bretton Woods)	6.96%	2.45%	1.65%	2.52%	4.60%
1974-2016 (Post-Bretton Woods)	0.27%	8.62%	1.96%	2.08%	5.09%
1908-1945	-0.76%	3.61%	1.42%	0.48%	2.79%
1908-1960	-0.03%	4.91%	1.45%	1.03%	3.29%
1946-2016	2.80%	5.95%	2.02%	2.22%	4.95%
1961-2016	3.07%	5.34%	2.15%	2.16%	5.06%
1908-2016	1.55%	5.13%	1.81%	1.58%	4.20%

Panel B: Volatility of Real Returns by Period

Period	Art	Art (Unsmoothed)	Equity
1908-1913 (Pre-war)	12.38%	12.34%	1.68%
1914-1918 (WWI)	24.55%	26.38%	12.70%
1919-1938 (Interbellum)	24.72%	26.16%	21.05%
1939-1945 (WWII)	24.33%	25.53%	16.10%
1944-1973 (Bretton Woods)	22.61%	24.64%	22.94%
1974-2016 (Post-Bretton Woods)	13.69%	14.49%	20.81%
1908-1945	23.06%	24.62%	18.28%
1908-1960	20.30%	21.59%	18.58%
1946-2016	18.46%	19.87%	22.01%
1961-2016	19.99%	21.55%	22.78%
1908-2016	20.09%	21.52%	20.76%

Panel C: Sharpe Ratio by Period

	Art	Art (Unsmoothed)	Equity
1908-1913 (Pre-war)	-0.90%	-0.90%	-110.86%
1914-1918 (WWI)	13.90%	12.94%	2.93%
1919-1938 (Interbellum)	-11.92%	-11.26%	21.83%
1939-1945 (WWII)	59.94%	57.12%	72.34%
1944-1973 (Bretton Woods)	41.54%	38.11%	23.99%
1974-2016 (Post-Bretton Woods)	1.47%	1.39%	44.86%
1908-1945	6.63%	6.22%	24.10%
1908-1960	10.50%	9.88%	33.76%
1946-2016	20.74%	19.27%	35.03%
1961-2016	19.39%	17.99%	29.99%
1908-2016	15.10%	14.10%	31.62%

Panel D: Art Mean Real Return by Crisis

Year	Crisis	Real Art Return	Real Equity Return	Real GDP Growth	Real Consumption Growth	Inflation
Economic and Financial Crises						
1930	Great Depression	-17.06%	-8.25%	-1.07%	1.09%	-2.80%
1931	Great Depression	-62.87%	-15.87%	-5.49%	0.62%	-4.30%
1956	1956 Recession	5.41%	-6.00%	1.53%	0.01%	5.16%
1974	Mid-1970s Recessions	-22.95%	101.69%	-1.71%	-1.46%	15.73%
1975	Mid-1970s Recessions	-17.63%	-11.22%	-0.47%	-0.13%	22.70%
1980	Early 1980s Recession	-7.18%	17.60%	2.31%	-0.23%	15.15%
1981	Early 1980s Recession	-4.70%	1.56%	-3.00%	-0.19%	11.81%
1990	Early 1990s Recession	1.51%	-17.45%	1.52%	0.44%	6.97%
1991	Early 1990s Recession	-37.34%	15.59%	-1.27%	-1.93%	7.53%
2008	Great Recession	-11.82%	-30.59%	-1.09%	0.02%	3.60%
2009	Great Recession	-16.51%	27.07%	-5.12%	-3.87%	2.17%
War Times						
1914	World War I	-24.39%	6.37%	-0.48%	-0.42%	-0.30%
1915	World War I	-32.36%	-17.71%	6.77%	1.53%	12.50%
1916	World War I	20.62%	-25.45%	1.22%	-8.68%	18.10%
1917	World War I	19.22%	-4.89%	0.07%	-8.04%	25.20%
1918	World War I	-11.81%	-2.23%	0.10%	-0.86%	22.00%
1919	Post–WWI Recession	-5.43%	-10.92%	-11.45%	14.54%	10.10%
1920	Post–WWI Recession	-21.80%	-22.96%	-7.26%	-0.39%	15.40%
1921	Post–WWI Recession	-40.46%	65.02%	-2.74%	-0.11%	-8.60%
1939	World War II	-14.28%	-4.68%	0.00%	-0.50%	2.80%
1940	World War II	-13.57%	-17.23%	9.56%	-9.93%	16.80%
1941	World War II	13.23%	27.23%	9.20%	-4.03%	10.80%
1942	World War II	15.76%	25.60%	2.17%	-1.45%	7.10%
1943	World War II	58.64%	12.87%	1.44%	-1.99%	3.40%
1944	World War II	7.97%	13.59%	-4.30%	2.55%	2.70%
1945	World War II	13.11%	2.92%	-4.65%	5.98%	2.80%

Table 3. Crisis Classification

This table presents the classification of crises: Economic and Financial Crises and Systemic Shocks and War Crises. The Economic and Financial Crises are defined as two successive quarters of negative economic growth, as measured by the seasonally adjusted quarter-on-quarter figures for real GDP. The systemic crises are identified by Schularick and Taylor (2012) as events during which a country's banking sector experiences bank runs, sharp increases in default rates accompanied by large losses of capital that result in public intervention, bankruptcy, or forced mergers of financial institutions.

Crises	Event	Date	Duration (years)	Note
Economic and Financial Crises	Post–WWI Recession	1919-1921	3	The end of World War I
	Great Depression	1930-1931	2	US Depression reducing demand for UK exports (in UK aka the Great Slump), high interest rate defending the gold standard
	1956 Recession	1956Q2-1956Q3	0.5 (2 quarters)	Inflationary pressures, credit squeeze caused by high bank interest rates, effects of the Suez crisis – oil embargo by Arab countries
	Mid-1970s Recessions	1973Q3-1974Q1	0.75 (3 quarters)	1973 oil crisis, stagflation, decline of traditional British industries, inefficient production, high inflation caused industrial disputes over pay
		1975Q2-1975Q3	0.5 (2 quarters)	
	Early 1980s Recession	1980Q1-1981Q1	1.25 (5 quarters)	Deflationary government policies including spending cuts, pursuance of monetarism to reduce inflation, switch from a manufacturing economy to a services economy
	Early 1990s Recession	1990Q3-1991Q3	1.25 (5 quarters)	US Savings & Loans crisis, UK high bank interest rates in response to rising inflation caused by the Lawson Boom and to maintain British membership of the Exchange Rate Mechanism
	Great Recession	2008Q2-2009Q2	1.25 (5 quarters)	Financial crisis, rising global commodity prices, subprime mortgage crisis infiltrating the British banking sector, significant credit crunch
Systemic Shocks		1974, 1991, 2007		In the UK, largely overlapping with periods of Economic and Financial Crises
War Crises	World War I	1914Q3-1918Q4	4.25	UK is the leading Allied Power
	World War II	1939Q3-1945Q3	6	The contribution of the British Empire and Commonwealth in terms of manpower and materiel was critical to the Allied war-effort
	Early War Periods	1914Q3-1915Q4; 1939Q3-1941Q1		The Early War Period for the semiannual series includes: WWI: 1914H2, 1915H1, 1915H2; WWII: 1939H2, 1940H1, 1940H2, 1941H1.
	Late War Periods	1916Q1-1918Q4; 1941Q2-1945Q3		The Late War Period for the semiannual series includes: WWI: 1916H1, 1916H2, 1917H1, 1917H2, 1918H1, 1918H2; WWII: 1941H2, 1942H1, 1942H2, 1943H1, 1943H2, 1944H1, 1944H2, 1945H2.

Table 4. Art in Economic and Financial Crises, and War Times

This table presents six panels with OLS regressions of the impact of crises on art returns. The dependent variables are real art returns (biannual series) and transaction volume changes. The key independent variables in Panels A and B are crises dummies (*Economic & Financial Crises* and *War Times*); The crises dummy equal 1 if there are crises in the period and 0 otherwise (see crisis classification in Table 3). The regression is formulated as $Art_t=\alpha+\beta D_{crises}+\varepsilon_t$. Panel A shows art returns (Columns (1)–(4)) and volume changes (Columns (5)–(8)) during economic and financial crises and war times. Panel B shows the art return regressions of subsamples: sub-periods 1907–1960 and 1961–2016 in Columns (1)–(2), liquid and non-liquid sales in Columns (3)–(4), high-end and low-end markets stratified by the 90th and 10th price percentiles in Columns (5)–(6), and artists by nationality in Columns (7)–(11). The liquid (non-liquid) subsample includes paintings of the artists who sold more (less) than five paintings per period. The equity return series are obtained from the UK FTSE All-Share Return Index in Global Financial Data (note that the stock index uses Bank of England shares exclusively before 1922, the Banker's Magazine Index of All Variable Dividend shares from 1922 until 1932, the Actuaries General Share index from 1932 to 1962 and the All-Share index from 1964); *GDP* is the real GDP per capita growth from the Jordà-Schularick-Taylor Macro-history Database; *Inequality* is the change of net personal wealth in 99.9th to 100th percentiles from World Inequality Database. *, **, and *** indicate the statistical significance at the 10%, 5%, and 1% levels, respectively. Robust t-statistics are reported in parentheses.

Panel A: Art Returns and Volume Changes in Crises (Real, Biannual Results)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	art	art	art	art	volume	volume	volume	volume
Economic & Financial Crises	-0.1475***	-0.1364***	-0.1557***	-0.1076***	-0.0577	-0.0260	-0.1012	0.0797
	(-4.60)	(-4.09)	(-3.81)	(-2.75)	(-0.41)	(-0.18)	(-0.77)	(0.68)
Early War Period	-0.0885	-0.0761	-0.0398	-0.0817	-0.2953	-0.2603	-0.5151***	-0.6730***
	(-1.22)	(-1.03)	(-0.45)	(-0.71)	(-1.38)	(-1.21)	(-2.75)	(-3.27)
Late War Period	0.0647	0.0688	0.3903***	0.3066***	0.0673	0.0816	1.2860***	0.9709***
	(1.03)	(1.10)	(16.70)	(5.32)	(0.37)	(0.44)	(12.95)	(3.22)
$Equity_{(t-1)}$		0.1319	0.0618	0.0554		0.3323	0.3150	0.2910
		(1.15)	(0.54)	(0.52)		(0.84)	(0.74)	(0.71)
Inequality			-0.0206	-0.1052			-0.0861	-0.4044
			(-0.08)	(-0.37)			(-0.17)	(-0.75)
GDP				2.4932*				9.3784
				(1.86)				(1.45)
Observations	214	213	165	165	214	213	165	165
R-squared	0.0616	0.0650	0.0755	0.0898	0.0047	0.0061	0.0256	0.0376

Panel B: Art Returns in Crises per Subsamples (of Time, Liquidity, Price Segment, Artist Nationality) (Real, Biannual Results)

VARIABLES	(1) 1907-1960	(2) 1961-2016	(3) Liquid Sales	(4) Non Liquid Sales	(5) 90^{th}–100^{th} Percentile	(6) 0^{th}–10^{th} Percentile	(7) British	(8) Belgian	(9) Dutch	(10) French	(11) Italian
Economic & Financial Crises	-0.1530**	-0.0926	-0.0866	-0.1350	-0.1768*	-0.1330***	-0.0859	-0.2709***	-0.1796***	-0.1463	-0.2853***
	(-2.52)	(-1.62)	(-0.71)	(-1.06)	(-1.66)	(-3.2288)	(-0.7761)	(-3.2774)	(-2.7998)	(-1.2456)	(-3.2165)
Early War Period	-0.0067		-0.0325	-0.0249	-0.0143	-0.1284**	-0.0429	-0.3160*	-0.3298*	0.3374	-0.3935***
	(-0.06)		(-0.13)	(-0.10)	(-0.0518)	(-2.0177)	(-0.2064)	(-1.8335)	(-1.6844)	(0.5990)	(-3.0659)
Late War Period	0.3734***		1.4310***	0.8362***	1.6017***	-0.1452*	0.4445***	0.2883***	0.3367***	-0.1501	-0.1494
	(7.01)		(11.49)	(6.08)	(14.4899)	(-1.8602)	(3.4900)	(3.0114)	(3.8326)	(-0.9668)	(-1.2187)
$Equity_{(t-1)}$	0.2510	-0.0384	0.0350	0.0027	0.3037	-0.0501	0.0144	-0.0522	0.0575	0.4755*	-0.0667
	(1.36)	(-0.25)	(0.11)	(0.01)	(1.0234)	(-0.4296)	(0.0458)	(-0.2635)	(0.2907)	(1.8055)	(-0.2897)
Inequality	0.6729	-0.3428	0.1299	-0.0887	0.1787	-0.3667	-0.2325	-0.3658	0.0145	-0.1368	-0.5888
	(1.49)	(-0.89)	(0.19)	(-0.11)	(0.3893)	(-0.9377)	(-0.4003)	(-0.8523)	(0.0367)	(-0.2705)	(-1.1731)
GDP	0.6611	3.9060	2.3771	1.9618	2.6081	1.4553	4.0961	3.1567	5.6367**	6.2212	6.6792**
	(0.43)	(1.34)	(0.72)	(0.56)	(0.8908)	(1.0043)	(1.3141)	(1.2776)	(2.4930)	(1.4638)	(2.2098)
Observations	83	82	165	165	165	165	165	165	165	165	165
R-squared	0.2709	0.0422	0.0767	0.0325	0.1482	0.0276	0.0318	0.0924	0.1264	0.0944	0.0887

Table 5. Art in War Times

This table presents art returns and volume changes in World War I and the post-World War I recession period (Panel A) and World War II (Panel B). We consider returns of subsamples based on artist's oeuvre's liquidity, price quantile, and a painting's size. For the liquidity subsample, liquid (non-liquid) sales include paintings of an artists who sold more (less) than five paintings per year. For the price quantiles subsample, we consider the 90th, 75th, 50th, 25th, and 10th percentiles. For the size subsample, a painting is classified as a small (large) painting if its size is below (above) the size median.

Panel A: Art Returns in World War I

Returns	**World War I**					**Post World War I Recession**		
	1914	**1915**	**1916**	**1917**	**1918**	**1919**	**1920**	**1921**
Overall Returns and Volume Changes:								
Return	-24.39%	-32.36%	20.62%	19.22%	-11.81%	-5.43%	-21.80%	-40.46%
Volume Changes	-36.07%	-43.02%	99.08%	27.08%	-18.98%	37.28%	-5.70%	-45.39%
Returns for the subsample (Il)Liquid Paintings:								
Liquid Sales	-20.07%	-20.48%	16.96%	24.38%	-20.94%	-13.73%	-17.54%	-23.85%
Non-liquid Sales	-21.13%	-13.17%	8.49%	9.01%	5.03%	-11.11%	-21.94%	-42.56%
Returns by Price Percentile:								
90th–100th	-30.29%	-46.05%	7.44%	33.55%	-9.32%	7.68%	-31.42%	-50.88%
75th–100th	-26.13%	-37.62%	12.77%	27.05%	-10.12%	-0.96%	-27.36%	-43.71%
50th–75th	-21.43%	-23.13%	13.71%	25.06%	-6.37%	-10.18%	-27.58%	-33.46%
25th–50th	-18.73%	-16.42%	13.25%	18.61%	1.40%	-13.37%	-26.56%	-29.41%
0th–25th	-17.49%	-6.84%	8.45%	7.19%	9.35%	-17.04%	-20.43%	-26.96%
0th–10th	-7.77%	-12.21%	1.20%	10.11%	3.86%	-6.27%	-21.82%	-15.58%
Returns by Painting's Size:								
Small Paintings	-9.62%	-3.98%	4.85%	11.15%	-13.46%	-9.64%	-8.58%	-33.85%
Large Paintings	-29.64%	-23.42%	18.79%	27.27%	-8.88%	-14.50%	-25.30%	-36.85%

Panel B: Art Returns in World War II

Returns	**1939**	**1940**	**1941**	**1942**	**1943**	**1944**	**1945**
Overall Returns and Volume Changes:							
Return	-14.28%	-13.57%	13.23%	15.76%	58.64%	7.97%	13.11%
Volume Changes	-30.67%	-42.95%	-9.45%	79.05%	-40.14%	4.87%	39.23%
Returns by subsample (II)Liquid Paintings:							
Liquid Sales	-9.87%	-1.08%	6.46%	17.63%	38.59%	26.55%	7.85%
Non-liquid Sales	-13.32%	-13.54%	8.40%	24.17%	79.91%	6.12%	13.25%
Returns by Price Quantile:							
90^{th}–100^{th} Percentile	-7.63%	-37.22%	42.65%	3.22%	19.94%	16.25%	2.83%
75^{th}–100^{th} Percentile	-15.00%	-21.81%	21.49%	3.36%	45.70%	8.43%	8.58%
50^{th}–75^{th} Percentile	-11.35%	-10.43%	-4.78%	29.55%	58.20%	9.09%	15.49%
25^{th}–50^{th} Percentile	-10.31%	-12.74%	-3.82%	36.00%	80.53%	10.85%	17.81%
0^{th}–25^{th} Percentile	-8.30%	-8.32%	-6.16%	8.30%	169.37%	4.23%	13.66%
0^{th}–10^{th} Percentile	-6.06%	-4.75%	-10.43%	-8.09%	218.45%	-22.18%	18.72%
Returns by Painting's Size:							
Small Paintings	-14.53%	-4.94%	8.15%	23.86%	44.61%	15.81%	8.48%
Large Paintings	-15.32%	-10.07%	2.00%	28.49%	74.46%	18.40%	8.11%

Table 6. Optimal Painting Size over Time

The measurement coefficients (*Height, Height Squared, Width, Width Squared, Size,* and *Size Squared*) are obtained from hedonic price regressions (see Section 3.2.1). For the data in Panel A, we included *Height* and *Height Squared* in a hedonic regression; for Panel B, we included *Width* and *Width Squared*; in Panel C, we combined *Height*, *Height Squared, Width,* and *Width Squared*; for Panel D, we included *Size* and *Size Squared* in the hedonic regression. We excluded from our sample the observations with measurements below the 1st percentile or above the 99th percentile. The optimal measurements in terms of pricing are calculated as -coefficient(measurement)/(2*coefficient(measurement squared term)), which is the maximum point in the quadratic function. Optimal height and width are in centimeters; optimal size is in square centimeters.

	Whole Period	**1907-1913**	**1914-1918**	**1919-1939**	**1939-1945**	**1944-1973**	**1974-2016**
Panel A: Optimal Height							
Coefficient Height $(\times 10^{-2})$	1.9635	2.6386	2.1129	1.5434	1.2020	1.3270	2.3238
Coefficient Height Squared $(\times 10^{-4})$	-0.5546	-0.8051	-0.6543	-0.4845	-0.4252	-0.4230	-0.6396
Optimal Height (cm)	177	164	161	159	141	157	182
Panel B: Optimal Width							
Coefficient Width $(\times 10^{-2})$	1.7826	2.3252	2.0693	1.4016	1.1058	1.1817	2.0896
Coefficient Width Squared $(\times 10^{-4})$	-0.4663	-0.6346	-0.6239	-0.3949	-0.3610	-0.3334	-0.5271
Optimal Width (cm)	191	183	166	177	153	177	198
Panel C: Optimal Height and Width							
Coefficient Height $(\times 10^{-2})$	0.9506	1.2651	0.8981	0.7036	0.5073	0.5834	1.1918
Coefficient Width $(\times 10^{-2})$	1.0622	1.3901	1.4312	0.8922	0.7513	0.7965	1.1745
Coefficient Height Squared $(\times 10^{-4})$	-0.2730	-0.3820	-0.2872	-0.2236	-0.2099	-0.2114	-0.3412
Coefficient Width Squared $(\times 10^{-4})$	-0.2739	-0.3890	-0.4550	-0.2598	-0.2339	-0.2241	-0.2741
Optimal Height (cm)	174	166	156	157	121	138	175
Optimal Width (cm)	194	179	157	172	161	178	214
Panel D: Optimal Size							
Coefficient Size $(\times 10^{-4})$	1.1513	1.4645	1.1330	0.7671	0.5925	0.6598	1.4430
Coefficient Size Squared $(\times 10^{-8})$	-0.2400	-0.3100	-0.2400	-0.1500	-0.1500	-0.1300	-0.3100
Optimal Size (cm^2)	23985	23620	23604	25568	19750	25377	23275

Table 7. Time Series Alpha Regression

This table estimates the relation between excess art return and excess equity and bond returns (all in semi-annual nominal terms). The 3-month T-Bill rates are from Global Financial Data (GFD) and proxy for the risk-free rate. The crises dummy equal 1 if there are crises in the period and 0 otherwise. The *equity* return series are obtained from the UK FTSE All-Share Return Index in GFD (the stock index uses Bank of England shares exclusively before 1922, the Banker's Magazine Index of All Variable Dividend shares from 1922 until 1932, the Actuaries General Share index from 1932 to 1962 and the All-Share index from 1964). The *bond* return series are the 10-year Government Bond total return from Global Financial Data. *, **, and *** indicate the statistical significance at the 10%, 5%, and 1% levels, respectively. Robust t-statistics are reported in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.:			Excess Art Return			
Excess Equity	0.3505***	0.3482***	0.3472**	0.3389***	0.3152***	0.3026***
	(2.62)	(2.64)	(2.60)	(2.61)	(2.72)	(2.68)
Excess Bond	-0.5323**	-0.5225**	-0.5382**	-0.5268**	-0.5280**	-0.5302**
	(-2.23)	(-2.17)	(-2.25)	(-2.19)	(-2.21)	(-2.20)
War Times		0.0643				
		(1.37)				
Early War Period			-0.0544			-0.0637
			(-0.82)			(-0.95)
Late War Period				0.1212**		0.1047*
				(2.25)		(1.90)
Economic & Financial Crises					-0.1259***	-0.1211***
					(-3.94)	(-3.73)
Alpha	0.0174	0.0111	0.0193	0.0098	0.0331**	0.0282*
	(1.28)	(0.76)	(1.38)	(0.69)	(2.25)	(1.77)
Observations	214	214	214	214	214	214
Adjusted R-squared	0.0399	0.0440	0.0375	0.0565	0.0735	0.0841

Table 8. Optimal Portfolio Allocations including Art

This table presents the optimal portfolio allocation of financial assets and art for the period 1908-2016 (Panel A), non-crisis periods (Panel B), economic and financial crises (Panel C) and war times (Panel D). *Art* is the return series from the adjusted art index. The *equity* return series are obtained from the UK FTSE All-Share Return Index in Global Financial Data (GFD) (the stock index uses Bank of England shares exclusively before 1922, the Banker's Magazine Index of All Variable Dividend shares from 1922 until 1932, the Actuaries General Share index from 1932 to 1962 and the All-Share index from 1964). The *bond* return series are the 10-year Government Bond total return from GFD; The *T-bill* is the UK 3-month treasury bill rates from GFD, which proxy for the risk-free rate to calculate the Sharpe Ratio. *Gold* return is obtained from the London Gold Price (GBP/Oz.) in GFD; *Housing* return series is from the house price index in Jordà-Schularick-Taylor Macroeconomic-history Database. Panel E presents the correlation table of the various asset classes. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Whole Period (1908-2016)

	Without Art	With Art	Without Art	With Art	Without Art	With Art	Without Art	With Art	Without Art	With Art
Art	-	20.06%	-	19.38%	-	19.38%	-	14.36%	-	8.12%
Equity	100.00%	79.94%	100.00%	74.80%	100.00%	74.80%	73.78%	58.03%	41.34%	36.29%
Bond	-	-	0.00%	5.82%	0.00%	5.82%	0.00%	5.76%	1.67%	5.63%
T-Bill	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gold	-	-	-	-	-	-	26.22%	21.85%	10.73%	10.27%
Housing	-	-	-	-	-	-	-	-	46.25%	39.69%
Portfolio Return	5.33%	5.23%	5.33%	5.09%	5.33%	5.09%	4.74%	4.63%	3.90%	3.94%
Portfolio SD	12.99%	11.76%	12.99%	11.19%	12.99%	11.19%	9.85%	8.86%	5.99%	5.89%
Return-Risk ratio	0.4101	0.4445	0.4101	0.4547	0.4101	0.4547	0.4816	0.5223	0.6514	0.6685
Sharpe Ratio	0.2294	0.2449	0.2294	0.2450	0.2294	0.2450	0.2433	0.2575	0.2596	0.2702

Panel B: Non-crisis Period

	Without Art	With Art	Without Art	With Art	Without Art	With Art	Without Art	With Art	Without Art	With Art
Art	-	17.65%	-	16.02%	-	16.02%	-	13.63%	-	8.14%
Equity	100.00%	82.35%	90.44%	69.12%	90.44%	69.12%	75.41%	59.91%	44.66%	39.80%
Bond	-	-	9.56%	14.86%	9.56%	14.86%	9.12%	13.70%	7.45%	10.43%
T-Bill	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gold	-	-	-	-	-	-	15.47%	12.76%	4.38%	4.35%
Housing	-	-	-	-	-	-	-	-	43.51%	37.28%
Portfolio Return	5.88%	5.87%	5.61%	5.45%	5.61%	5.45%	5.21%	5.14%	4.22%	4.33%
Portfolio SD	11.10%	10.35%	10.25%	9.09%	10.25%	9.09%	8.75%	8.02%	5.46%	5.48%
Return-Risk ratio	0.5295	0.5667	0.5475	0.5996	0.5475	0.5996	0.5950	0.6413	0.7743	0.7899
Sharpe Ratio	0.3207	0.3428	0.3213	0.3446	0.3213	0.3446	0.3303	0.3524	0.3495	0.3668

Panel C: Economic and Financial Crisis

	Without Art	With Art	Without Art	With Art	Without Art	With Art	Without Art	With Art	Without Art	With Art
Art	-	0.00%	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Equity	100.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bond	-	-	100.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
T-Bill	-	-	-	-	100.00%	100.00%	39.40%	39.41%	39.40%	39.41%
Gold	-	-	-	-	-	-	60.60%	60.59%	60.60%	60.59%
Housing	-	-	-	-	-	-	-	-	0.00%	0.00%
Portfolio Return	2.55%	2.55%	3.39%	3.39%	3.51%	3.51%	3.53%	3.53%	3.53%	3.53%
Portfolio SD	23.51%	23.51%	9.44%	9.44%	2.05%	2.05%	7.84%	7.84%	7.84%	7.84%
Return-Risk ratio	0.1084	0.1084	0.3592	0.3592	1.7113	1.7113	0.4506	0.4506	0.4506	0.4506
Sharpe Ratio	-0.0410	-0.0410	-0.0130	-0.0130	0.0000	0.0000	0.0025	0.0025	0.0025	0.0025

Panel D: War Times

	Without Art	With Art	Without Art	With Art	Without Art	With Art	Without Art	With Art	Without Art	With Art
Art	-	30.23%	-	30.23%	-	6.37%	-	3.81%	-	7.14%
Equity	100.00%	69.77%	100.00%	69.77%	22.69%	18.67%	17.88%	14.24%	0.00%	0.00%
Bond	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	2.30%	0.00%	0.00%
T-Bill	-	-	-	-	77.31%	74.96%	69.03%	67.13%	19.13%	27.33%
Gold	-	-	-	-	-	-	13.09%	12.52%	34.75%	26.83%
Housing	-	-	-	-	-	-	-	-	46.12%	38.70%
Portfolio Return	4.23%	5.92%	4.23%	5.92%	1.88%	2.31%	1.80%	2.02%	4.27%	4.38%
Portfolio SD	7.93%	10.14%	7.93%	10.14%	1.68%	2.32%	1.32%	1.61%	2.47%	1.80%
Return-Risk ratio	0.5337	0.5833	0.5337	0.5833	1.1213	0.9953	1.3596	1.2526	1.7289	2.4359
Sharpe Ratio	0.3833	0.4657	0.3833	0.4657	0.4109	0.4812	0.4596	0.5115	1.2459	1.7722

Panel E: Pairwise Correlations of Art and Other Assets

Whole Period	**Art**	**Equity**	**Bond**	**T-Bill**	**Gold**	**Housing**	**CPI**
Art	1						
Equity	0.1513**	1					
Bond	-0.0896	0.3923***	1				
T-Bill	0.0486	0.0733	0.1252*	1			
Gold	0.0093	-0.0899	-0.0672	0.1323*	1		
Housing	0.1240*	-0.0002	-0.0827	0.3634***	0.2363***	1	
CPI	0.0117	0.0609	0.0319	0.3521***	0.1184*	0.3550***	1
Financial Crisis							
Art	1						
Equity	0.0827	1					
Bond	-0.1189	0.6429***	1				
T-Bill	0.3430*	0.2849	0.0445	1			
Gold	-0.1006	-0.3154	-0.1883	-0.1026	1		
Housing	0.4312**	0.0830	-0.0810	0.6141***	-0.0279	1	
CPI	0.3628*	0.4167**	0.0084	0.6260***	-0.0328	0.3013	1
Non-Crisis Period							
Art	1						
Equity	0.1469*	1					
Bond	-0.0810	0.2999***	1				
T-Bill	0.0974	0.0401	0.1436*	1			
Gold	0.0255	-0.0246	-0.0424	0.1742**	1		
Housing	0.1100	-0.0442	-0.0901	0.4009***	0.3268***	1	
CPI	-0.0061	-0.0584	0.0715	0.4396***	0.2790***	0.2981***	1
War Time							
Art	1						
Equity	0.4393**	1					
Bond	-0.0759	0.2551	1				
T-Bill	-0.0704	-0.3600	-0.3631	1			
Gold	0.0332	-0.1698	-0.2435	-0.1109	1		
Housing	-0.5740	0.5645	0.4404	0.0137	-0.7731**	1	
CPI	-0.1637	-0.1483	0.2931	0.6485***	-0.4334**	0.7609**	1

Art in Times of Crisis

Online Appendix

Online Appendix I. Hedonic Variable Definitions

This table presents the definitions of variables in hedonic regressions.

Variable	Definition
Ln(Price)	Ln(Price) is the natural logarithm of deflated hammer price in GBP.
Height	The height of a painting measured in centimeters.
Height Squared	The squared term of variable Height.
Width	The width of a painting measured in centimeters.
Width Squared	The squared term of variable Width.
Oil	Oil refers to the Oil/Acrylic Painting category based on the medium of a painting.
Watercolor	Watercolor refers to the Watercolor (or gouache) category based on the medium of a painting.
Drawing	Drawing refers to the Colored Drawing category based on the medium of a painting.
Signed	Signed is a dummy variable that equals 1 if the artwork bears physically identifiable signature(s) in various forms: full names, monograms, initials, countersignatures, and stamps.
Dated	Dated is a dummy variable that equals 1 if the artwork bears physically identifiable date(s).
Inscribed	Inscribed is a dummy variable that equals 1 if the artwork bears physically identifiable inscription(s).
Attribution	Attribution variables (Attributed, Studio, Circle, School, After, Style) are dummy variables equal to 1 if the auctioned object had been recognized and disclosed by the auction house at the following levels: 1) attributed to the artist, 2) from the studio of the artist, 3) from the circle of the artist, 4) from the school of the artist, 5) after the artist, or 6) in the style or manner of the artist.
Provenance	Provenance is a dummy variable that equals 1 if there is textual information in the catalog about the provenance information (past ownership, previous sales information, exhibition records, literature coverage, etc.) of the auctioned lot.
Deceased	Deceased is a dummy variable that equals 1 if the artist is dead before the sale of the auctioned lot.
Sotheby's	Sotheby's is a dummy variable that equals 1 if the sale takes place at Sotheby's London.
Christie's	Christie's is a dummy variable that equals 1 if the sale takes place at Christie's London.
Year	Year variables are dummies to control the time effect of auctions, and the coefficients of year dummies are used to construct an art price index.
Month	Month variables are dummies to control the seasonality of auctions. In the auction world, the spring (in May and June) and fall auctions (in November and December) are the busiest and most important of the year.

Online Appendix II. Descriptive Statistics of the Hedonic Variables

This table presents the descriptive statistics of the hedonic variables. Panel A presents the statistics of the full sample, including oil paintings, watercolors, and drawings. Panel B presents the sample of oil paintings. *Deceased* equals 1 in case the artist is deceased at the time of the sale. The attribution dummies *Attributed*, *Studio*, *Circle*, *School*, *After*, and *Style* equal 1 if the auction catalog identifies the work as "attributed to" the artist, from his "studio," from his "circle," from the artist's "school," "after" the artist, or "in the style of" the artist, respectively. The dummies *Signed*, *Dated*, and *Inscribed* take the value 1 if the work carries a signature, is dated, or is inscribed, respectively. The medium dummies *Oil*, *Watercolor*, and *Drawing* indicate whether the work is an oil (or acrylic) painting, a watercolor (or gouache), or a drawing, respectively. The variables *Height* and *Width* measure the height and width of the work in centimeters (winsorized at 1% and 99%), respectively. The month dummies indicate the sales month. *Sotheby's* and *Christie's* equal 1 if a sale is made in those auction houses. *Provenance* equals 1 if the artwork contains any provenance information. For each variable, we report the number of observations (N), the mean, the standard deviation (S.D.), the minimum, and the maximum.

Panel A: Full Sample

	N	Mean	S.D.	Min	Max
Artwork Characteristics					
Attribution Dummies					
Attributed	616,844	0.0236	0.1518	0	1
Studio	616,844	0.0042	0.0647	0	1
Circle	616,844	0.0213	0.1443	0	1
School	616,844	0.0029	0.0536	0	1
After	616,844	0.0115	0.1068	0	1
Style	616,844	0.0293	0.1686	0	1
Signature Dummies					
Signed	616,844	0.4208	0.4937	0	1
Dated	616,844	0.2519	0.4341	0	1
Inscribed	616,844	0.1212	0.3263	0	1
Medium Dummies					
Oil	616,844	0.7084	0.4545	0	1
Watercolor	616,844	0.1493	0.3564	0	1
Drawing	616,844	0.1423	0.3494	0	1
Measurement Variables					
Height	605,779	55.06	39.42	10.16	200.00
Width	604,944	59.03	43.00	10.16	198.70
Topic Dummies					
Abstract	616,844	0.0083	0.0906	0	1
Animals	616,844	0.0632	0.2433	0	1
Landscape	616,844	0.1705	0.3761	0	1
Seascape	616,844	0.0476	0.2129	0	1
Urbanscape	616,844	0.1086	0.3111	0	1
Nude	616,844	0.0116	0.1069	0	1
People	616,844	0.1556	0.3625	0	1
Self Portrait	616,844	0.0023	0.0482	0	1
Portrait	616,844	0.0781	0.2683	0	1
Religion	616,844	0.0509	0.2198	0	1
Still Life	616,844	0.0561	0.2300	0	1
Study	616,844	0.0198	0.1393	0	1
Untitled	616,844	0.0124	0.1107	0	1
Other Topic	616,844	0.3917	0.4881	0	1
Provenance					
Provenance	616,844	0.1591	0.3658	0	1

Transaction Characteristics					
Month					
January	616,844	0.0258	0.1585	0	1
February	616,844	0.0794	0.2704	0	1
March	616,844	0.1036	0.3047	0	1
April	616,844	0.0911	0.2877	0	1
May	616,844	0.0833	0.2763	0	1
June	616,844	0.1399	0.3469	0	1
July	616,844	0.1387	0.3456	0	1
August	616,844	0.0125	0.1109	0	1
September	616,844	0.0273	0.1630	0	1
October	616,844	0.0685	0.2526	0	1
November	616,844	0.1134	0.3171	0	1
December	616,844	0.1165	0.3209	0	1
Auction House					
Sotheby's	616,844	0.2954	0.4562	0	1
Christie's	616,844	0.4341	0.4956	0	1

Panel B: Oil Paintings

	N	**Mean**	**S.D.**	**Min**	**Max**
Artwork Characteristics					
Attribution Dummies					
Attributed	436,959	0.0244	0.1543	0	1
Studio	436,959	0.0055	0.0742	0	1
Circle	436,959	0.0277	0.1640	0	1
School	436,959	0.0037	0.0611	0	1
After	436,959	0.0156	0.1238	0	1
Style	436,959	0.0402	0.1963	0	1
Signature Dummies					
Signed	436,959	0.3718	0.4833	0	1
Dated	436,959	0.2218	0.4154	0	1
Inscribed	436,959	0.0829	0.2757	0	1
Measurement Variables					
Height	428,518	63.79	41.21	12.70	210.82
Width	428,061	68.27	45.39	12.70	210.82
Topic Dummies					
Abstract	436,959	0.0053	0.0724	0	1
Animals	436,959	0.0683	0.2522	0	1
Landscape	436,959	0.1834	0.3870	0	1
Seascape	436,959	0.0495	0.2170	0	1
Urbanscape	436,959	0.1051	0.3066	0	1
Nude	436,959	0.0051	0.0714	0	1
People	436,959	0.1670	0.3730	0	1
Self Portrait	436,959	0.0017	0.0415	0	1
Portrait	436,959	0.0925	0.2898	0	1
Religion	436,959	0.0599	0.2373	0	1
Still Life	436,959	0.0673	0.2505	0	1
Study	436,959	0.0096	0.0974	0	1
Untitled	436,959	0.0084	0.0910	0	1
Other Topic	436,959	0.3729	0.4836	0	1
Provenance					
Provenance	436,959	0.1424	0.3494	0	1

Transaction Characteristics					
Month					
January	436,959	0.0267	0.1612	0	1
February	436,959	0.0855	0.2796	0	1
March	436,959	0.1016	0.3021	0	1
April	436,959	0.0950	0.2932	0	1
May	436,959	0.0922	0.2893	0	1
June	436,959	0.1367	0.3435	0	1
July	436,959	0.1386	0.3455	0	1
August	436,959	0.0126	0.1117	0	1
September	436,959	0.0231	0.1503	0	1
October	436,959	0.0658	0.2479	0	1
November	436,959	0.1053	0.3069	0	1
December	436,959	0.1170	0.3214	0	1
Auction House					
Sotheby's	436,959	0.2744	0.4462	0	1
Christie's	436,959	0.4831	0.4997	0	1

Online Appendix III. Hedonic Price Regressions by Periods (Oil Paintings)

This table presents the baseline hedonic price regression results. Equation (1) is estimated using OLS. The dependent variable is the natural log of deflated hammer prices in GBP. The definitions of independent variables are discussed in Section 3 (Data and Methodology). Column (1) shows the results using the oil paintings' sample over the whole period. Columns (2)–(7) show results for the subsamples by period: pre-war period (1908–1913), World War I (1914–1918), interwar period and Great Depression (1919–1939), World War II (1939–1945), Bretton Woods period (1944–1973) and Post-Bretton Woods era (1974–2016), respectively. FE stands for fixed effects. *, **, and *** indicate the statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors (S.E.) are reported in parentheses and clustered at the auction branch level.

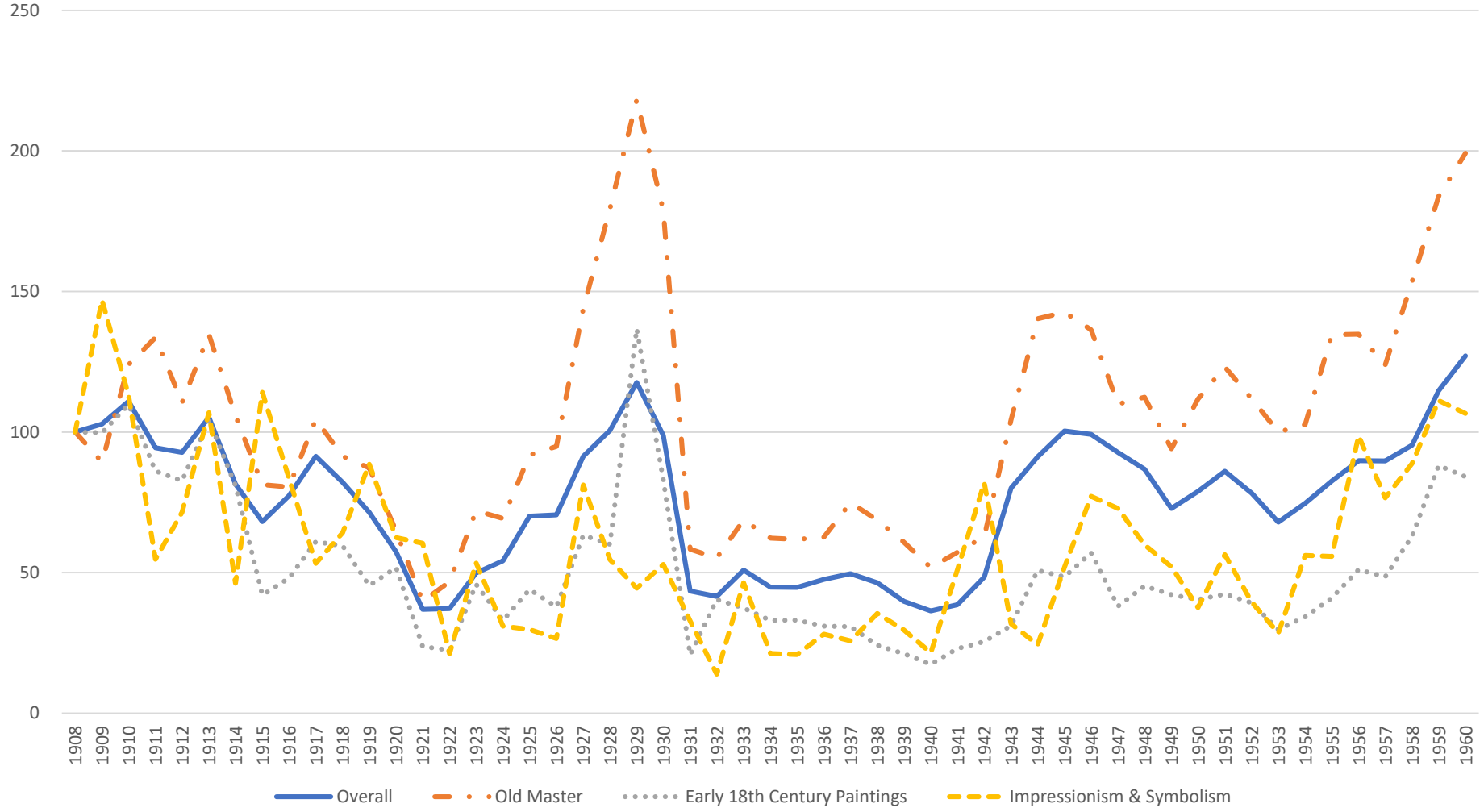
Dept.Var:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Ln(Price)	**Whole Period**	**1908-1913**	**1914-1918**	**1919-1939**	**1939-1945**	**1944-1973**	**1974-2016**
				Artwork Characteristics			
Authenticity Dummies							
Signed	0.1436***	0.6160	0.5912**	0.3466**	0.3048***	0.2056***	0.2118***
	(0.0153)	(0.2319)	(0.0834)	(0.1540)	(0.0932)	(0.0119)	(0.0170)
Dated	0.2270***	0.3253***	0.2229***	0.2895***	0.1634***	0.1829***	0.1870***
	(0.0168)	(0.0141)	(0.0131)	(0.0026)	(0.0209)	(0.0079)	(0.0050)
Size Variables							
Height	0.0062***	0.0072***	0.0074***	0.0049***	0.0022*	0.0030***	0.0075***
	(0.0005)	(0.0002)	(0.0004)	(0.0001)	(0.0012)	(0.0004)	(0.0005)
Width	0.0043***	0.0131***	0.0121***	0.0076***	0.0063***	0.0050***	0.0048***
	(0.0002)	(0.0001)	(0.0004)	(0.0003)	(0.0019)	(0.0004)	(0.0003)
Height Squared	-0.0533***	-0.0636***	-0.1820***	-0.0810***	-0.0100	-0.0357***	-0.0628***
($\times 10^{-4}$)	(0.0039)	(0.0006)	(0.0119)	(0.0080)	(0.0589)	(0.0102)	(0.0052)
Width Squared	0.0168***	-0.3070***	-0.3178***	-0.1811***	-0.1524*	-0.0517***	0.0199***
($\times 10^{-4}$)	(0.0015)	(0.0047)	(0.0137)	(0.0082)	(0.0736)	(0.0023)	(0.0022)
Attribution Dummies							
Attributed	-0.6084***	-1.2997**		-0.8192***	-0.8390***	-0.5187***	-0.6630***
	(0.0466)	(0.2433)		(0.0085)	(0.0610)	(0.0744)	(0.0306)
Studio	-0.4705***			1.8759***	-0.4269***	-0.0830	-0.6969***
	(0.1764)			(0.0442)	(0.0353)	(0.2165)	(0.1369)
Circle	-0.7280***	0.3655***		1.0272***	-0.2986***	-0.1200	-0.8700***
	(0.1454)	(0.0140)		(0.0304)	(0.0500)	(0.0802)	(0.1082)
School	-0.4751***	-0.4635***	-0.3663***	-0.2924***	-0.1157**	-0.4506***	-0.9373***
	(0.0721)	(0.0374)	(0.0025)	(0.0516)	(0.0481)	(0.0853)	(0.1238)
After	-1.3656***	-1.6504***	-1.6446***	-1.0707***	-0.5286*	-1.0010***	-1.5817***
	(0.1575)	(0.0404)	(0.0197)	(0.2197)	(0.2923)	(0.1450)	(0.1603)
Style	-1.1855***	-0.5084***	-1.0396***	1.2170***	-2.0337***	-0.8277***	-1.3737***
	(0.1611)	(0.0213)	(0.0028)	(0.0946)	(0.0623)	(0.1103)	(0.1262)

Topic Dummies							
Abstract	-0.0662*	-0.6160**	0.0910**	0.5509**	0.1350	0.0682	-0.1199***
	(0.0343)	(0.0655)	(0.0152)	(0.2544)	(0.8070)	(0.0952)	(0.0247)
Animals	-0.0201	-0.0468***	0.0958***	0.0813***	-0.0425	0.1037**	-0.1102***
	(0.0394)	(0.0037)	(0.0086)	(0.0068)	(0.0912)	(0.0461)	(0.0152)
Landscape	0.0146	-0.0540**	0.1705***	0.1776***	-0.0481	0.0784***	-0.0813***
	(0.0456)	(0.0061)	(0.0019)	(0.0056)	(0.0301)	(0.0278)	(0.0063)
Seascape	0.0167	-0.0725**	0.1222**	0.1088***	-0.0733***	0.1019***	-0.0233**
	(0.0253)	(0.0085)	(0.0151)	(0.0028)	(0.0193)	(0.0351)	(0.0097)
Urbanscape	0.1448***	0.0788***	0.2564***	0.2748***	0.1918***	0.2004***	0.0670***
	(0.0353)	(0.0073)	(0.0032)	(0.0033)	(0.0276)	(0.0181)	(0.0128)
Nude	-0.0833***	-0.6748	0.6537***	0.0644	-0.2171*	-0.1435***	-0.0977***
	(0.0225)	(0.7140)	(0.0095)	(0.1426)	(0.1181)	(0.0243)	(0.0258)
People	0.0462	0.0821***	0.1701**	0.1516***	0.0215	0.1033***	-0.0337***
	(0.0345)	(0.0077)	(0.0180)	(0.0042)	(0.0232)	(0.0254)	(0.0059)
Self_Portrait	0.2118***			-0.0419	0.0129	0.1822	0.1873***
	(0.0435)			(0.4837)	(0.2988)	(0.2562)	(0.0428)
Portrait	-0.1300*	0.0900*	0.2574***	0.2399***	0.0202	-0.1192***	-0.2175***
	(0.0728)	(0.0290)	(0.0093)	(0.0234)	(0.0449)	(0.0367)	(0.0129)
Religion	-0.0340	-0.0121	-0.0436**	0.0465***	0.0371	0.0125	-0.0951***
	(0.0277)	(0.0169)	(0.0072)	(0.0125)	(0.0522)	(0.0354)	(0.0140)
Still_Life	0.1304***	0.1362***	0.1689***	0.3245***	0.1368***	0.2354***	0.0427***
	(0.0433)	(0.0020)	(0.0131)	(0.0065)	(0.0183)	(0.0303)	(0.0122)
Study	-0.2280***	-0.5531**	-0.5564***	-0.1224***	-0.0549	-0.1145	-0.2434***
	(0.0189)	(0.0692)	(0.0174)	(0.0327)	(0.1880)	(0.1103)	(0.0150)
Untitled	-0.1660***					-0.0778	-0.1669***
	(0.0229)					(0.0867)	(0.0197)
Provenance							
Provenance	0.5465***	1.0440***	0.5924***	0.7471***	0.4295***	0.4402***	0.4488***
	(0.0619)	(0.0263)	(0.0062)	(0.0175)	(0.0480)	(0.0183)	(0.0546)
Transaction Characteristics							
Auction House							
Sotheby's	0.7458***	-0.0422	0.3818	0.3134***	-0.1965**	0.1990*	0.6958***
	(0.0841)	(0.0346)	(0.1719)	(0.0774)	(0.0715)	(0.1005)	(0.0755)
Christie's	0.7873***	0.8855***	1.1040***	0.4696***	0.1067	0.1821*	0.7243***
	(0.0823)	(0.0511)	(0.0474)	(0.0813)	(0.0681)	(0.0968)	(0.0794)

Month							
February	0.1300***	0.4385***	0.2274***	-0.0145***	0.0061	0.0014	0.0959
	(0.0280)	(0.0144)	(0.0033)	(0.0036)	(0.0938)	(0.1090)	(0.0610)
March	0.2385***	0.3778***	0.2943***	-0.0646***	-0.0220	0.1918	0.2831***
	(0.0731)	(0.0237)	(0.0060)	(0.0029)	(0.0335)	(0.1580)	(0.0714)
April	0.3002***	0.4142***	0.3224***	-0.0155*	-0.0505	0.0665	0.3336***
	(0.0701)	(0.0097)	(0.0052)	(0.0074)	(0.0602)	(0.1366)	(0.0900)
May	0.3218***	0.6543***	0.4186***	0.2268***	0.0605	0.0654	0.2041***
	(0.0368)	(0.0019)	(0.0037)	(0.0167)	(0.0377)	(0.0700)	(0.0454)
June	0.3970***	0.8135***	0.4262***	0.1173***	0.0393	0.2791*	0.3740***
	(0.0424)	(0.0124)	(0.0154)	(0.0045)	(0.0397)	(0.1417)	(0.0690)
July	0.4023***	0.5638**	0.3860***	0.1277***	0.0064	0.2091	0.4204***
	(0.0561)	(0.0661)	(0.0247)	(0.0038)	(0.0548)	(0.1422)	(0.0837)
August	0.0592		0.1886	-0.0520***	-0.0934	-0.1371	0.1565*
	(0.0806)		(0.2572)	(0.0170)	(0.0887)	(0.1640)	(0.0899)
September	0.0533				0.2926*	0.0757	0.0892*
	(0.0525)				(0.1498)	(0.1657)	(0.0476)
October	0.1489***			0.2383	0.1425	0.1438	0.1248**
	(0.0379)			(0.1715)	(0.1070)	(0.1242)	(0.0590)
November	0.3677***	0.3165***	0.5263***	-0.0049	0.2055**	0.2867**	0.4067***
	(0.0759)	(0.0147)	(0.0043)	(0.0312)	(0.0761)	(0.1333)	(0.0860)
December	0.4319***	0.3295***	0.4501***	0.0463	0.1171**	0.2618	0.4680***
	(0.0983)	(0.0070)	(0.0028)	(0.0274)	(0.0523)	(0.1905)	(0.0814)
Artist FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
# of Obs.	417,338	24,308	13,723	68,411	10,114	63,840	233,371
Adj. R-squared	0.7053	0.5014	0.4658	0.4128	0.4078	0.6303	0.7340

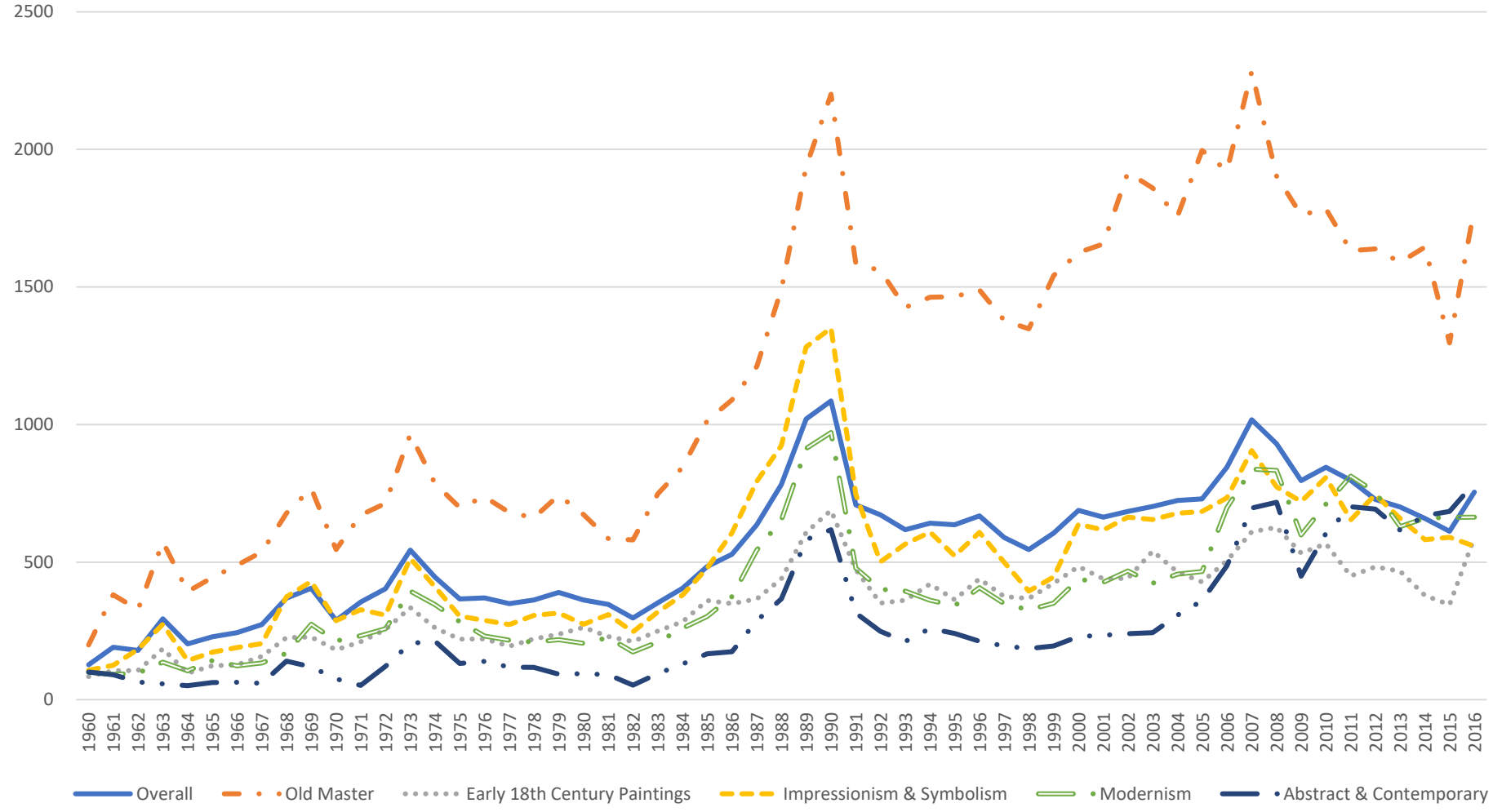
Online Appendix IV. Price Indices of Art Movements: 1908–1960

This figure presents the real price indices of art movements from 1908 to 1960, including the following: (i) Old Masters (*Medieval and Renaissance*; *Baroque*; *Rococo*); (ii) early 18th century paintings (*Neoclassicism*; *Romanticism*; *Realism*); (iii) *Impressionism and Symbolism*. As the historical data source *Art Prices Current* started the records in November 1907, there are only 761 auction observations available in total in 1907. To avoid sample bias in 1907, we use the auction records from 1908 and the years onwards in our main analysis.



Online Appendix V. Price Indices of Art Movements: 1961–2016

This figure presents the real price indices of art movements from 1961 to 2016, including the following: (i) Old Masters (*Medieval and Renaissance*; *Baroque*; *Rococo*); (ii) early 18th century paintings (*Neoclassicism*; *Romanticism*; *Realism*); (iii) *Impressionism and Symbolism*; (iv) Modernism (*Fauvism and Expressionism*; *Cubism, Futurism, and Constructivism*; *Dada and Surrealism*); (v) Abstract and Contemporary (*Abstract Expressionism*; *Pop*; *Minimalism and Contemporary*).



Online Appendix VI. Hedonic Price Regressions 1908-2016

This table presents the baseline hedonic price regression results from Equation (1), estimated using OLS. The dependent variable is the natural log of deflated hammer price in GBP. The definitions of independent variables are discussed in Section 3 (Data and Methodology). Panel A uses the full sample, including oil paintings, watercolors, and drawings. Panel B uses the sample of oil paintings. Column (1) shows the baseline results using the whole sample. Columns (2)–(4) show the results for the subsamples of sales in London, Christie's & Sotheby's (C&S), and Christie's, respectively. FE stands for fixed effects. *, **, and *** indicate the statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors (S.E.) are reported in parentheses and clustered at the auction branch level.

Panel A: Full Sample

Dept. Var: Ln(Price)	**(1) Baseline**	**(2) London Sales**	**(3) C&S**	**(4) Christie's**
		Artwork Characteristics		
Authenticity Dummies				
Signed	0.1776***	0.2176***	0.2242***	0.2580***
	(0.0145)	(0.0050)	(0.0052)	(0.0080)
Dated	0.2037***	0.2060***	0.2090***	0.2102***
	(0.0170)	(0.0048)	(0.0050)	(0.0070)
Size Variables				
Height	0.0064***	0.0063***	0.0063***	0.0058***
	(0.0006)	(0.0002)	(0.0002)	(0.0007)
Width	0.0047***	0.0057***	0.0057***	0.0080***
	(0.0002)	(0.0005)	(0.0005)	(0.0005)
Height Squared	-0.0537***	-0.0559***	-0.0544***	-0.0783**
($\times 10^{-4}$)	(0.0082)	(0.0078)	(0.0076)	(0.0318)
Width Squared	0.0163***	-0.0234	-0.0222	-0.1139***
($\times 10^{-4}$)	(0.0036)	(0.0169)	(0.0160)	(0.0185)
Attribution Dummies				
Attributed	-0.5643***	-0.5529***	-0.5532***	-0.5209***
	(0.0546)	(0.0118)	(0.0132)	(0.0215)
Studio	-0.4418**	-0.6196***	-0.6920***	-0.6695***
	(0.1953)	(0.0219)	(0.0247)	(0.0435)
Circle	-0.6638***	-0.8693***	-0.9001***	-0.9002***
	(0.1703)	(0.0110)	(0.0129)	(0.0182)
School	-0.5388***	-0.5536***	-0.5580***	-0.4899***
	(0.1018)	(0.0356)	(0.0361)	(0.0553)
After	-1.3715***	-1.5653***	-1.6006***	-1.5948***
	(0.1881)	(0.0195)	(0.0217)	(0.0358)
Style	-1.1216***	-1.3015***	-1.2956***	-1.3194***
	(0.1858)	(0.0116)	(0.0127)	(0.0207)
Medium Dummies				
Oil	0.8802***	0.8413***	0.8192***	0.6543***
	(0.1574)	(0.0075)	(0.0075)	(0.0105)
Watercolor	0.1635	0.1080***	0.0916***	-0.0596***
	(0.1357)	(0.0070)	(0.0074)	(0.0116)
Topic Dummies				
Abstract	-0.0898***	-0.0690***	-0.0674***	-0.0355
	(0.0201)	(0.0176)	(0.0185)	(0.0329)
Animals	-0.0268	-0.0067	-0.0028	0.0116
	(0.0356)	(0.0074)	(0.0077)	(0.0098)
Landscape	0.0029	0.0278***	0.0378***	0.0587***
	(0.0417)	(0.0049)	(0.0052)	(0.0069)
Seascape	0.0173	0.0303***	0.0334***	0.0490***
	(0.0210)	(0.0080)	(0.0084)	(0.0113)
Urbanscape	0.1201***	0.1398***	0.1492***	0.1613***
	(0.0306)	(0.0057)	(0.0059)	(0.0079)
Nude	-0.1614***	-0.1653***	-0.1584***	-0.1551***

Dept. Var: Ln(Price)	**(1) Baseline**	**(2) London Sales**	**(3) C&S**	**(4) Christie's**
	(0.0182)	(0.0154)	(0.0163)	(0.0271)
People	0.0144	0.0359***	0.0422***	0.0671***
	(0.0331)	(0.0053)	(0.0055)	(0.0073)
Self_Portrait	0.2182***	0.2260***	0.2186***	0.1645**
	(0.0273)	(0.0368)	(0.0388)	(0.0652)
Portrait	-0.1093*	-0.1096***	-0.1033***	-0.0324***
	(0.0629)	(0.0084)	(0.0088)	(0.0118)
Religion	-0.0614**	-0.0706***	-0.0665***	-0.0423***
	(0.0263)	(0.0090)	(0.0094)	(0.0127)
Still_Life	0.1491***	0.1880***	0.1922***	0.1918***
	(0.0382)	(0.0085)	(0.0089)	(0.0127)
Study	-0.2382***	-0.2438***	-0.2484***	-0.2892***
	(0.0242)	(0.0129)	(0.0138)	(0.0211)
Untitled	-0.1977***	-0.2354***	-0.2380***	-0.2844***
	(0.0298)	(0.0152)	(0.0160)	(0.0253)
Provenance				
Provenance	0.5252***	0.4236***	0.4031***	0.4427***
	(0.0642)	(0.0065)	(0.0070)	(0.0106)
Transaction Characteristics				
Auction House				
Sotheby's	0.7727***	0.5008***	-0.0465***	
	(0.0880)	(0.0063)	(0.0037)	
Christie's	0.8194***	0.5468***		
	(0.0870)	(0.0064)		
Month				
February	0.1181***	0.1409***	0.1515***	0.1208***
	(0.0336)	(0.0114)	(0.0123)	(0.0149)
March	0.1987***	0.2483***	0.2520***	0.1745***
	(0.0637)	(0.0111)	(0.0121)	(0.0146)
April	0.2602***	0.3061***	0.3143***	0.2482***
	(0.0567)	(0.0113)	(0.0123)	(0.0151)
May	0.2716***	0.3201***	0.3275***	0.3056***
	(0.0501)	(0.0115)	(0.0125)	(0.0151)
June	0.3729***	0.4179***	0.4283***	0.3469***
	(0.0512)	(0.0110)	(0.0120)	(0.0145)
July	0.3767***	0.4283***	0.4369***	0.3688***
	(0.0540)	(0.0110)	(0.0120)	(0.0146)
August	0.0663	0.0568***	0.0556***	-0.0897***
	(0.0730)	(0.0187)	(0.0202)	(0.0308)
September	0.0459	-0.0309*	-0.0122	0.0196
	(0.0373)	(0.0168)	(0.0193)	(0.0311)
October	0.1065***	0.1292***	0.1353***	0.1377***
	(0.0334)	(0.0117)	(0.0128)	(0.0163)
November	0.3425***	0.3970***	0.4064***	0.3089***
	(0.0698)	(0.0110)	(0.0121)	(0.0149)
December	0.3800***	0.4412***	0.4478***	0.3087***
	(0.0868)	(0.0111)	(0.0121)	(0.0148)
Artist FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
# of Obs.	593,565	466,562	429,125	250,245
Adj. R-squared	0.6763	0.6939	0.7006	0.6929

Panel B: Oil Paintings

Dept. Var: Ln(Price)	(1) Baseline	(2) London Sales	(3) C&S	(4) Christie's
		Artwork Characteristics		
Authenticity Dummies				
Signed	0.1436***	0.1946***	0.2008***	0.2441***
	(0.0153)	(0.0063)	(0.0065)	(0.0097)
Dated	0.2270***	0.2210***	0.2229***	0.2299***
	(0.0168)	(0.0060)	(0.0062)	(0.0083)
Size Variables				
Height	0.0062***	0.0058***	0.0057***	0.0051***
	(0.0005)	(0.0002)	(0.0002)	(0.0006)
Width	0.0043***	0.0051***	0.0051***	0.0074***
	(0.0002)	(0.0004)	(0.0003)	(0.0005)
Height Squared	-0.0533***	-0.0463***	-0.0459***	-0.0567**
($\times 10^{-4}$)	(0.0039)	(0.0054)	(0.0055)	(0.0252)
Width Squared	0.0168***	-0.0190	-0.0178	-0.1067***
($\times 10^{-4}$)	(0.0015)	(0.0119)	(0.0113)	(0.0180)
Attribution Dummies				
Attributed	-0.6084***	-0.5936***	-0.5990***	-0.5820***
	(0.0466)	(0.0139)	(0.0155)	(0.0255)
Studio	-0.4705***	-0.6646***	-0.7403***	-0.7100***
	(0.1764)	(0.0227)	(0.0257)	(0.0474)
Circle	-0.7280***	-0.9499***	-0.9704***	-0.9861***
	(0.1454)	(0.0120)	(0.0141)	(0.0206)
School	-0.4751***	-0.4748***	-0.4768***	-0.4323***
	(0.0721)	(0.0370)	(0.0375)	(0.0573)
After	-1.3656***	-1.5589***	-1.5881***	-1.5523***
	(0.1575)	(0.0196)	(0.0219)	(0.0360)
Style	-1.1855***	-1.3832***	-1.3784***	-1.4049***
	(0.1611)	(0.0123)	(0.0135)	(0.0221)
Topic Dummies				
Abstract	-0.0662*	-0.0188	-0.0153	-0.0134
	(0.0343)	(0.0272)	(0.0287)	(0.0501)
Animals	-0.0201	-0.0006	0.0044	0.0181*
	(0.0394)	(0.0084)	(0.0088)	(0.0107)
Landscape	0.0146	0.0386***	0.0454***	0.0663***
	(0.0456)	(0.0057)	(0.0059)	(0.0077)
Seascape	0.0167	0.0314***	0.0337***	0.0483***
	(0.0253)	(0.0093)	(0.0096)	(0.0125)
Urbanscape	0.1448***	0.1665***	0.1756***	0.1812***
	(0.0353)	(0.0069)	(0.0072)	(0.0093)
Nude	-0.0833***	-0.0492*	-0.0417	-0.0237
	(0.0225)	(0.0256)	(0.0268)	(0.0432)
People	0.0462	0.0710***	0.0803***	0.0982***
	(0.0345)	(0.0061)	(0.0063)	(0.0081)
Self_Portrait	0.2118***	0.2352***	0.2284***	0.1181
	(0.0435)	(0.0515)	(0.0552)	(0.0902)
Portrait	-0.1300*	-0.1277***	-0.1221***	-0.0429***
	(0.0728)	(0.0095)	(0.0100)	(0.0128)
Religion	-0.0340	-0.0377***	-0.0330***	-0.0178
	(0.0277)	(0.0101)	(0.0106)	(0.0138)
Still_Life	0.1304***	0.1713***	0.1767***	0.1811***
	(0.0433)	(0.0095)	(0.0099)	(0.0136)
Study	-0.2280***	-0.2147***	-0.2064***	-0.1854***
	(0.0189)	(0.0221)	(0.0237)	(0.0326)
Untitled	-0.1660***	-0.1691***	-0.1676***	-0.2227***

Dept. Var: Ln(Price)	**(1) Baseline**	**(2) London Sales**	**(3) C&S**	**(4) Christie's**
	(0.0229)	(0.0227)	(0.0239)	(0.0375)
Provenance				
Provenance	0.5465***	0.4353***	0.4321***	0.4781***
	(0.0619)	(0.0080)	(0.0085)	(0.0126)
Transaction Characteristics				
Auction House				
Sotheby's	0.7458***	0.4653***	-0.0435***	
	(0.0841)	(0.0077)	(0.0045)	
Christie's	0.7873***	0.5094***		
	(0.0823)	(0.0077)		
Month				
February	0.1300***	0.1244***	0.1334***	0.1281***
	(0.0280)	(0.0126)	(0.0134)	(0.0157)
March	0.2385***	0.2549***	0.2600***	0.1980***
	(0.0731)	(0.0125)	(0.0133)	(0.0156)
April	0.3002***	0.3088***	0.3171***	0.2708***
	(0.0701)	(0.0127)	(0.0135)	(0.0160)
May	0.3218***	0.3411***	0.3446***	0.3460***
	(0.0368)	(0.0129)	(0.0137)	(0.0160)
June	0.3970***	0.4064***	0.4159***	0.3720***
	(0.0424)	(0.0124)	(0.0132)	(0.0155)
July	0.4023***	0.4203***	0.4273***	0.3747***
	(0.0561)	(0.0124)	(0.0132)	(0.0156)
August	0.0592	0.0120	0.0125	-0.1225***
	(0.0806)	(0.0207)	(0.0221)	(0.0322)
September	0.0533	-0.0549***	-0.0638***	-0.0421
	(0.0525)	(0.0211)	(0.0242)	(0.0389)
October	0.1489***	0.1361***	0.1400***	0.1417***
	(0.0379)	(0.0132)	(0.0142)	(0.0177)
November	0.3677***	0.3971***	0.4032***	0.3387***
	(0.0759)	(0.0126)	(0.0134)	(0.0161)
December	0.4319***	0.4438***	0.4429***	0.3276***
	(0.0983)	(0.0125)	(0.0133)	(0.0158)
Artist FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
# of Obs.	417,338	337,457	312,950	195,528
Adj. R-squared	0.7053	0.7272	0.7332	0.7162

Online Appendix VII. Hedonic Regressions on Art Movements

This table presents the results of hedonic price regressions of movements subsamples. In Panel A, we classify 13 movements: (1) *Medieval and Renaissance*; (2) *Baroque*; (3) *Rococo*; (4) *Neoclassicism*; (5) *Romanticism*; (6) *Realism*; (7) *Impressionism and Symbolism*; (8) *Fauvism and Expressionism*; (9) *Cubism, Futurism and Constructivism*; (10) *Dada and Surrealism*; (11) *Abstract Expressionism*; (12) *Pop*; (13) *Minimalism and Contemporary*. In Panel B, we combine the movements into five categories: (i) Old Masters (*Medieval and Renaissance; Baroque; Rococo*); (ii) early 18th century painting (*Neoclassicism; Romanticism; Realism*); (iii) Impress. & Sym. (*Impressionism and Symbolism*); (iv) Modernism (*Fauvism and Expressionism; Cubism, Futurism and Constructivism; Dada and Surrealism*); (v) Abstract & Contemp. (*Abstract Expressionism; Pop; Minimalism and Contemporary*). FE stands for fixed effects. *, **, and *** indicate the statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors (S.E.) are reported in parentheses and clustered at the auction branch level.

Panel A: Thirteen Art Movements

Dept. Var:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Ln(Price)	**Whole Period**	**1908-1913**	**1914-1918**	**1919-1939**	**1939-1945**	**1944-1973**	**1974-2016**
Mediev/Rennais	0.6300***	0.0183	0.0058	0.3363***	0.3779***	0.5981***	0.8012***
	(0.0116)	(0.0717)	(0.0837)	(0.0282)	(0.0574)	(0.0229)	(0.0152)
Baroque	0.2166***	-0.4726***	-0.2519***	-0.0703***	-0.0562*	0.1915***	0.3630***
	(0.0060)	(0.0366)	(0.0437)	(0.0163)	(0.0340)	(0.0122)	(0.0077)
Rococo	0.4944***	0.0518	0.0421	0.3584***	0.3390***	0.5682***	0.5118***
	(0.0110)	(0.0604)	(0.0680)	(0.0276)	(0.0614)	(0.0222)	(0.0143)
Neoclass	0.1658***	-0.9944***	-0.1659	-0.0227	-0.0265	0.1939***	0.3196***
	(0.0189)	(0.1081)	(0.1212)	(0.0476)	(0.1198)	(0.0410)	(0.0241)
Romant	0.4016***	0.5246***	0.4145***	0.6410***	0.4245***	0.3935***	0.2807***
	(0.0129)	(0.0648)	(0.0908)	(0.0398)	(0.0813)	(0.0258)	(0.0153)
Reaisml	0.0960***	0.9137***	0.1939**	0.1753***	-0.1504*	0.2990***	-0.0357**
	(0.0129)	(0.0656)	(0.0877)	(0.0398)	(0.0805)	(0.0304)	(0.0152)
Impress/Sym	0.9904***	0.3705***	0.5407***	0.5030***	0.6326***	1.0759***	1.0151***
	(0.0126)	(0.1021)	(0.1482)	(0.0523)	(0.0656)	(0.0265)	(0.0152)
Fauv/Expres	1.1806***					1.1507***	1.2027***
	(0.0157)					(0.0304)	(0.0182)
Cub/Futur/Cons	0.8594***					0.6719***	0.9010***
	(0.0207)					(0.0501)	(0.0226)
Dada/Surreal	1.0912***					0.9596***	1.1118***
	(0.0208)					(0.0554)	(0.0223)
AbstactExpres	0.2383***					0.1899*	0.2051***
	(0.0182)					(0.0978)	(0.0186)
Pop	0.8390***					0.7589***	0.8094***
	(0.0315)					(0.1763)	(0.0320)

Dept. Var:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Ln(Price)	**Whole Period**	**1908-1913**	**1914-1918**	**1919-1939**	**1939-1945**	**1944-1973**	**1974-2016**
Minim./Contemp	0.5674***					0.5956**	0.5135***
	(0.0268)					(0.2323)	(0.0273)
Year FE	YES	YES	YES	YES	YES	YES	YES
Month FE	YES	YES	YES	YES	YES	YES	YES
Auction House FE	YES	YES	YES	YES	YES	YES	YES
Hedonic Controls	YES	YES	YES	YES	YES	YES	YES
# of Obs.	303,620	9,400	5,424	34,026	6,166	50,032	201,524
Adj. R-squared	0.5247	0.2530	0.2014	0.2032	0.1834	0.4106	0.5037

Panel B: Five Groups of Movements

Dept. Var:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Ln(Price)	**Whole Period**	**1907-1913**	**1914-1918**	**1919-1939**	**1939-1945**	**1944-1973**	**1974-2016**
Old Masters	0.4536***	0.2521***	0.2391***	0.3496***	0.3461***	0.3582***	0.5291***
	(0.0052)	(0.0245)	(0.0284)	(0.0112)	(0.0241)	(0.0097)	(0.0077)
Early 18th C.	0.3597***	0.9689***	0.5861***	0.6063***	0.3853***	0.3947***	0.2491***
	(0.0086)	(0.0472)	(0.0585)	(0.0257)	(0.0546)	(0.0187)	(0.0104)
Impress & Sym.	1.1211***	0.8000***	0.8696***	0.7240***	0.8701***	1.1502***	1.1319***
	(0.0124)	(0.1001)	(0.1461)	(0.0521)	(0.0561)	(0.0263)	(0.0150)
Modernism	1.2851***					1.1447***	1.2893***
	(0.0117)					(0.0255)	(0.0131)
Abstract & Contemp	0.6468***					0.4309***	0.5501***
	(0.0151)					(0.0841)	(0.0155)
Year FE	YES	YES	YES	YES	YES	YES	YES
Month FE	YES	YES	YES	YES	YES	YES	YES
Auction House FE	YES	YES	YES	YES	YES	YES	YES
Hedonic Controls	YES	YES	YES	YES	YES	YES	YES
# of Obs.	426,439	26,952	16,107	74,110	11,933	68,017	235,088
Adj. R-squared	0.5525	0.1760	0.1644	0.1795	0.2082	0.4617	0.5095

Online Appendix VIII. Art in Economic and Financial Crises

This table presents the art returns and volume changes in Economic and Financial Crises, including the Great Depression, the 1956 recession, the Mid-1970s recessions, the early 1980s recession, the early 1990s recession, and the Great Recession (the post-World War I recession is listed in Table 5 Art in War Times). We consider the returns of several subsamples based on artist's oeuvre's liquidity, price quantile, art movement, artist's nationality, and a painting's size. For the liquidity subsample, the liquid (non-liquid) sales include paintings of the artists who sold more (less) than five paintings per year. For the price quantiles subsample, we consider the 90th, 75th, 50th, 25th, and 10th percentiles. For the movement subsample, we consider three categories of art: (i) Old Master: *Medieval & Renaissance*; *Baroque*; *Rococo*; (ii) Early 18th Century Paintings: *Neoclassicism*; *Romanticism*; *Realism*; (iii) Impress. & Sym.: *Impressionism & Symbolism*. For the nationality subsample, we consider British and non-British artists (and show for the latter category the artists from the Low Countries/Belgium/the Netherlands, France, and Italy). For the size subsample, a painting is classified as a small (large) painting if its size is below (above) the size median.

Crisis	**Great Depression**		**1956 Recession**	**Mid-1970s Recessions**		**Early 1980s Recession**		**Early 1990s Recession**	**Great Recession**	
Year	**1930**	**1931**	**1956**	**1974**	**1975**	**1980**	**1981**	**1991**	**2008**	**2009**
Overall Returns and Volume Changes:										
Return	-17.06%	-62.87%	5.41%	-22.95%	-17.63%	-7.18%	-4.70%	-37.34%	-11.82%	-16.51%
Volume Changes	-21.80%	26.90%	-6.49%	-6.06%	-17.56%	2.92%	-3.30%	-20.29%	-14.89%	-24.39%
Returns for the subsample (Il)Liquid Paintings:										
Liquid	1.57%	-67.23%	8.62%	-18.22%	-23.02%	-4.12%	-4.13%	-35.27%	-8.05%	-14.63%
Non-liquid Sales	-21.96%	-48.47%	6.98%	-16.66%	-11.65%	-9.14%	-5.55%	-31.94%	-6.96%	-12.08%
Returns by Price Percentile:										
90th–100th	-20.77%	-71.16%	19.15%	-16.42%	-27.60%	-11.36%	11.83%	-56.50%	4.03%	-36.96%
75th–100th	-20.51%	-66.15%	19.77%	-15.02%	-28.26%	-8.66%	0.91%	-53.24%	-0.80%	-29.27%
50th–75th	-23.67%	-59.90%	7.21%	-14.90%	-26.74%	-10.52%	-0.77%	-49.55%	10.25%	-30.39%
25th–50th	-22.55%	-50.33%	3.43%	-14.79%	-21.34%	-6.76%	-0.13%	-40.70%	10.53%	-21.72%
0th–25th	-11.28%	-42.54%	5.07%	-11.21%	-16.67%	-8.10%	-5.51%	-32.61%	9.83%	-11.09%
0th–10th	-0.76%	-43.80%	10.04%	-5.39%	-17.35%	-9.56%	-9.68%	-29.20%	7.62%	-5.71%
Returns for the Movements:										
Old Masters	-18.05%	-67.40%	0.20%	-18.62%	-10.95%	-9.43%	-12.98%	-27.96%	-16.64%	-7.41%
Early 18th C.	-39.35%	-74.94%	24.61%	-22.35%	-15.63%	10.19%	-12.54%	-31.34%	2.63%	-14.96%
Impress. & Sym.	19.01%	-38.12%	76.83%	-20.23%	-25.99%	-12.80%	12.64%	-44.73%	-14.53%	-6.85%
Modernism				-12.37%	-17.96%	-6.29%	10.52%	-50.79%	-0.60%	-28.11%
Abstract & Contemp				3.77%	-38.00%	2.74%	-4.50%	-49.03%	3.05%	-37.50%

Returns by Artist Nationality:										
British	-0.52%	-65.79%	-11.83%	-21.88%	-23.88%	-1.29%	-4.97%	-24.55%	-7.21%	-17.47%
Non-British	-19.39%	-64.95%	16.53%	-16.68%	-14.47%	-9.43%	-3.43%	-39.30%	-12.67%	-17.43%
Belgian	-23.54%	-67.57%	22.03%	-14.35%	-10.08%	-17.20%	-18.86%	-36.81%	-15.88%	-5.98%
Dutch	-14.82%	-63.79%	15.22%	-23.19%	-7.93%	-7.05%	-20.59%	-29.76%	-13.71%	-10.48%
French	-13.35%	-64.50%	38.15%	-17.82%	-21.90%	-7.73%	7.61%	-46.58%	-13.85%	-15.06%
Italian	-33.82%	-68.02%	-9.36%	-13.29%	-10.73%	2.85%	-2.57%	-29.67%	-24.25%	-11.09%
Returns by Painting's Size:										
Small Paintings	-12.23%	-56.36%	18.15%	-21.87%	-17.08%	-10.68%	-4.29%	-31.83%	-6.69%	-12.27%
Large Paintings	-18.29%	-56.38%	4.13%	-15.55%	-18.29%	-4.15%	-4.87%	-35.57%	-10.08%	-15.25%

Online Appendix IX. Definitions and Sources of Macroeconomic and Financial Data

In the source column, ***Maddison*** refers to the Maddison Project Database; ***Barro-Ursúa*** refers to the Barro-Ursúa Macroeconomic Data; ***JST*** refers to the Jordà-Schularick-Taylor Macro-history Database; ***WID*** refers to the World Inequality Database; ***GFD*** refers to the Global Financial Data; ***DMS*** refers to the Dimson-Marsh-Staunton Global Returns Dataset. The details of the databases are described in Subsection 3.1.2 (Macroeconomic and Financial Data). Series in Panels A and B are in GBP.

Panel A: Macroeconomic Variables

Variable	Definition	Period	Frequency	Source	Note
gdp_maddison	Real GDP per capita	1700–2016	Yearly	Maddison	in 2011 USD
gdp_barro	Real GDP per capita	1830–2009	Yearly	Barro-Ursúa	index, 2006=100 1830–1854 from Mitchell, B. R., British Historical Statistics, Cambridge University Press, Great Britain, Cambridge, 1988. 1855–1947 from Feinstein, O. H., National Income, Expenditure and Output of the United Kingdom, (Richard Stone, general editor), National Institute of Economic and Social Research / Department of Applied Economics, University of Cambridge, Cambridge University Press, London, 1972. 1948-2008 from UK National Statistics, UK Economic Accounts.
consumption_barro	Real Consumption per capita	1830–2009	Yearly	Barro-Ursúa	
consumption_jst	Real consumption per capita	1870–2016	Yearly	JST	index, 2006=100 1870–2009 from Barro and Ursúa (2010), Barro–Ursúa Macroeconomic Data. 2010–2016 from World Bank household final consumption expenditure per capita (constant 2010 USD).
gdp_jst	Real GDP per capita	1870–2016	Yearly	JST	index, 2006=100 1870–2004 from Barro and Ursúa (2010), Barro–Ursúa Macroeconomic Data. 2005–2016 growth rate calculated from World Bank (2018)
gdp_total_jst	GDP (GBP)	1870–2016	Yearly	JST	1870–1947 from Hills, Thomas and Dimsdale (2015) Three Centuries of Data, Version 2.2, Bank of England. 1948–2017 from Office for National Statistics.
cpi_jst	Consumer prices (index, 1990=100)	1870–2016	Yearly	JST	1870-2016 from Hills, Thomas, and Dimsdale, A millenium of macroeconomic data – version 3.1, Bank of England.
pound_usd_jst	GBP/USD	1870–2016	Yearly	JST	1870–1945 from Lawrence H. Officer, Exchange Rates Between the US Dollar and Forty-one Currencies, Measuring Worth, 2015. 1946–1955 from Reinhart and Rogoff (2010). From financial crash to debt crisis. (Black) market exchange rate. 1956–2014 from International Financial Statistics. IMF eLibrary.
wealth_total_wid	Changes of net total private wealth	1855–2017	Yearly	WID	[Net private wealth]=[Private non-financial assets]+[Private financial assets]-[Private debt]

Variable	Definition	Period	Frequency	Source	Note
wealth_average_wid	Changes of net average private wealth	1855–2017	Yearly	WID	[Net private wealth]=[Private non-financial assets]+[Private financial assets]-[Private debt] Average wealth of all ages (WID also provides average wealth of adults)
income_total_wid	Changes of total national income	1855–2017	Yearly	WID	[National income]=[Net domestic product]+[Net foreign income]
income_average_wid	Changes of average national income	1855–2017	Yearly	WID	[National income]=[Net domestic product]+[Net foreign income] Average national income of all ages (WID also provides average national income of adults)
share_top01_wid	Changes of net personal wealth percentile p99.9p100	1895–2009	Yearly	WID	0.1% level
share_top01_ap	Top 0.1% Shares in total before tax income	1913–2005	Yearly	Atkinson and Piketty (2010)	0.1% level

Panel B: Financial Markets

Variable	Definition	Period	Frequency	Source	Note
equity_dms	Equity total return	1899–2017	Yearly	DMS	
equity_gfd	UK FTSE All-Share Return	1694–2019	Monthly	GFD	The stock index uses Bank of England Shares data exclusively from 1694 to 1707, Bank of England Shares and East Indies Co. from 1708 to March 1874, and Bank of England Shares data exclusively from April 1874 to 1922. From 1923 until 1929, an index of stock yields using 5% as the base was used, and from 1930 on actual dividend yields are used. Yield data from 1923 until the present were calculated by the Actuaries for a broad index of shares. The stock price index uses the Banker's Magazine Index of All Variable Dividend shares from 1922 until 1932, the Actuaries General Share index from 1932 to 1962 and the All-Share index from 1964 onwards.
equity_tr_jst	Equity total return	1871–2015	Yearly	JST	r[t]=[[p[t]+d[t]]/p[t-1]]-1
equity_capgain_jst	Equity capital gain	1871–2015	Yearly	JST	cg[t]=[p[t]/p[t-1]]-1
equity_dividend_rtn_jst	Equity dividend return	1871–2015	Yearly	JST	dp_rtn[t]=dividend[t]/p[t-1]

Variable	Definition	Period	Frequency	Source	Note
equity_dividend_yd_jst	Equity dividend yield	1871–2015	Yearly	JST	dp[t]=dividend[t]/p[t]
bond_dms	Bond return	1899–2017	Yearly	DMS	
bond_tr_jst	Government bond total return		Yearly	JST	r[t]=[[p[t]+coupon[t]]/p[t-1]]-1
corp_bond_gfd	Corporate bond yield	1854–2019	Monthly	GFD	Inflation adjusted per capita Monthly from Jan 1854 to Nov 1983; Weekly From Dec 1983 To Oct 2011; Monthly from Nov 2011 To Mar 2019 Monthly data are taken from an index of corporate bond yields as calculated by the Bank of England and Financial Times. Weekly data are from The Economist. From November 2011, the Fixed Income Investor Corporate Bond Average is used.
govn_bond_jst	Government bond rate	1870–2015	Yearly	JST	rate[t]=coupon[t]/p[t-1], or yield to maturity at t
govn_bond_gfd	10-year Government Bond total return	1700–2019	Monthly	GFD	UK 10-year Government Bond Total Return Index Monthly from Jul 1700 to Mar 2019
usd_bond_gfd	USD bond return	1700–2019	Monthly	GFD	UK USD Bond Return Index; Inflation adjusted per capita Monthly from Jul 1700 to Mar 2019
bill_jst	Bill rate	1870–2015	Yearly	JST	r[t]=coupon[t]/p[t-1]
total_bill_gfd	Bills total return index	1694–2016	Monthly	GFD	The bill index uses the discount rate from the Bank of England from 1694 until 1718, the private discount rate from 1718 until 1869, the 3-month deposit rate from 1870 to 1899 and the 3-month yield on treasury bills from 1900 on.
treasury_bill_gfd	3-month treasury bill yield	1900–2019	Monthly	GFD	
capital_tr_jst	Total return on wealth	1896–2015	Yearly	JST	Weighted average of housing, equity, bonds and bills
risky_tr_jst	Total return on risky assets	1896–2015	Yearly	JST	Weighted average of housing and equity
safe_tr_jst	Total return on safe assets	1870–2015	Yearly	JST	Equally weighted average of bonds and bills
house_price_jst	House price index	1900–2016	Yearly	JST	nominal index, 1990=100 1899–1938 & 1946–2012 from Knoll et al. (2014). No price like home: Global house prices, 1870-2012.

Variable	Definition	Period	Frequency	Source	Note
					2013–2016 from OECD housing prices database.
housing_tr_jst	Housing total return	1896–2015	Yearly	JST	r[t]=[[p[t]+d[t]]/p[t-1]]-1
housing_capgain_jst	Housing capital gain	1896–2015	Yearly	JST	cg[t]=[p[t]/p[t-1]]-1
housing_rent_rtn_jst	Housing rental return	1896–2015	Yearly	JST	dp_rtn[t]=rent[t]/p[t-1]
housing_rent_yd_jst	Housing rental yield	1895–2015	Yearly	JST	dp[t]=rent[t]/p[t]
short_interest_jst	Short-term interest rate (percent per year)	1870–2016	Yearly	JST	1870–2016 from Measuring Worth, Short-Term Rate: Ordinary Funds, Contemporary Series. The Series emanates from the normal course of business of financial institutions, for example, the ordinary lending of funds by commercial banks for a short time period.
long_interest_jst	Long-term interest rate (percent per year)	1870–2016	Yearly	JST	1870–2008 from Hills, Sally, Ryland Thomas, and Nicholas Dimsdale (2010), The UK recession in context—what do three centuries of data tell us?, Quarterly Bulletin of the Bank of England, 2010:4. 2009–2016 from Bank of England. Statistical Database.

Online Appendix X. String Searches of Topics

This table presents string searches of topics. We categorize the paintings/drawing by topic based on the keywords of the artworks' titles. The textual analysis of the titles is executed in the six languages that are most often used in the art auction world and art history: English (EN), Dutch (NL), German (DE), French (FR), Spanish (ES), and Italian (IT). We identify 13 topic categories: Abstract, Animals, Landscape, Seascape, Urbanscape, Nude, People, Self Portrait, Portrait, Religion, Still Life, Study, and Untitled.

Abstract

- abstract (EN); abstract (NL); abstract (DE); abstrait (FR); abstracto (ES); abstraccion (ES); astratto (IT); abstracto (IT)
- compositions (EN); compositie (NL); composities (NL); samenstelling (NL); samenstellingen (NL); Komposition (DE); kompositionen (DE); zusammensetzung (DE); zusammensetzungen (DE); composition (FR); compositions (FR); composición (ES); composiciones (ES); composizione (IT); composizioni (IT)

Animals

- horse (EN); horses (EN); paard (NL); paarden (NL); Pferd (DE); Pferde (DE); cheval (FR); chevaux (FR); caballo (ES); caballos (ES); cavallo (IT); cavalli (IT)
- cow (EN); cows (EN); koe (NL); koeien (NL); kuh (DE); kühe (DE); kuehe (DE); vache (FR); vaches (FR); vaca (ES); vacas (ES); mucca (IT); mucche (IT)
- cattle (EN); livestock (EN); vee (NL); vieh (DE); bétail (FR); ganado (ES); bestiame (IT)
- pigs (EN); varken (NL); varkens (NL); schwein (DE); schweine (DE); cochon (FR); cochons (FR); cerdo (ES); cerdos (ES); maiale (IT); maiali (IT)
- chick (EN); chicken (EN); kip (NL); kippen (NL); henne (DE); Huhn (DE); poule (FR); poules (FR); gallina (IT); galline (IT)
- poultry (EN); poultries (EN); gevogelte (NL); gevogelte (NL); geflügel (DE); geflügel (DE); volaille (FR); volailles (FR); corral (ES); corral (ES); pollame (IT); pollame (IT)
- rooster (EN); roosters (EN); haan (NL); hanen (NL); hahn (DE); hähne (DE); coq (FR); coqs (FR); gallo (ES); gallos (ES); gallo (IT); galli (IT)
- cock (EN); cocks (EN); pik (NL); hanen (NL); schwanz (DE); hähne (DE); coq (FR); coqs (FR); polla (ES); pollas (ES); cazzo (IT); cazzi (IT)
- donkey (EN); donkeys (EN); ezel (NL); ezels (NL); esel (DE); esel (DE); âne (FR); ânes (FR); ane (FR); anes (FR); burro (ES); burros (ES); asino (IT); asini (IT)
- fish (EN); fishes (EN); vis (NL); vissen (NL); Fisch (DE); fische (DE); poisson (FR); poissons (FR); pez (ES); peces (ES); pesce (IT); Pesci (IT)
- cat (EN); cats (EN); kat (NL); katten (NL); Katze (DE); Katzen (DE); chat (FR); chats (FR); gato (ES); gatos (ES); gatto (IT); gatti (IT)
- dog (EN); dogs (EN); hond (NL); honden (NL); hund (DE); hunde (DE); chien (FR); chiens (FR); perro (ES); perros (ES); cane (IT); cani (IT)
- goat (EN); goats (EN); geit (NL); geiten (NL); ziege (DE); ziegen (DE); geiß (DE); geißen (DE); geiss (DE); geissen (DE); chèvre (FR); chèvres (FR); chevre (FR); chevres (FR); cabra (ES); cabras (ES); capra (IT); capre (IT)
- bock (EN); bocks (EN); bok (NL); boks (NL); ziegenbock (DE); ziegenböcke (DE); ziegenboecke (DE); bouc (FR); boucs (FR); macho cabrio (ES); capro (IT); capri (IT)
- bull (EN); bulls (EN); bul (NL); stieren (NL); stier (DE); Stiere (DE); taureau (FR); taureaux (FR); toro (ES); toros (ES); toro (IT); tori (IT)
- sheep (EN); sheeps (EN); schapen (NL); schapen (NL); schaf (DE); schafe (DE); mouton (FR); moutons (FR); oveja (ES); ovejas (ES); pecora (IT); pecore (IT)
- bird (EN); birds (EN); vogel (NL); vogelstand (NL); Vogel (DE); Vögel (DE); Voegel (DE); oiseau (FR); oiseaux (FR); ave (ES); aves (ES); pájaro (ES); pájaros (ES); uccello (IT); uccelli (IT)
- goose (EN); geese (EN); gans (NL); ganzen (NL); Gans (DE); Gänse (DE); Gaense (DE); oie (FR); oies (FR); ganso (ES); gansos (ES); oca (IT); oche (IT)
- owl (EN); owls (EN); uil (NL); uilen (NL); eule (DE); eulen (DE); hibou (FR); hiboux (FR); chouette (FR); chouettes (FR); búho (ES); búhos (ES); lechuza (ES); lechuzas (ES); gufo (IT); gufi (IT)
- grouse (EN); grouses (EN); kankeren (NL); grouses (NL); schneehuhn (DE); moorhühner (DE); moorhuehner (DE); grouse (FR); grouses (FR); gallo de abedul (ES); gallos de abedul (ES); gallo cedrone (IT); galli cedrone (IT)
- duck (EN); ducks (EN); eend (NL); eenden (NL); Ente (DE); Enten (DE); canard (FR); canards (FR); pato (ES); patos (ES); anatra (IT); anatre (IT)

- herd (EN); herds (EN); kudde (NL); kuddes (NL); herde (DE); herden (DE); troupeau (FR); troupeaux (FR); pastor (ES); pastore (IT); pastori (IT)
- farm (EN); farms (EN); boerderij (NL); boerderijen (NL); erf (NL); erfs (NL); boerenhof (NL); boerenhofs (NL); Farm (DE); farmen (DE); bauernhof (DE); bauernhöfe (DE); bauernhoefe (DE); gehöft (DE); gehöfte (DE); gehoeft (DE); gehoefte (DE); ferme (FR); fermes (FR); granja (ES); granjas (ES); finca (ES); fattoria (IT); fattorie (IT)
- stable (EN); stables (EN); shed (EN); sheds (EN); stall (DE); ställe (DE); staelle (DE); stal (NL); stallen (NL); écurie (FR); écuries (FR); ecurie (FR); ecuries (FR); bergerie (FR); bergeries (FR); porcherie (FR); porcheria (FR); bouverie (FR); (FR); estable (ES); establos (ES); stalla (IT); stalle (IT)

Landscape

- landscape (EN); landscapes (EN); landschap (NL); landschappen (NL); landschaft (DE); landschaften (DE); paysage (FR); paysages (FR); paisaje (ES); paisajes (ES); paesaggio (IT); paesaggi (IT)
- mountain (EN); mountains (EN); berg (NL); bergen (NL); berg (DE); berge (DE); montagne (FR); montagnes (FR); montaña (ES); montañas (ES); montana (ES); montanas (ES); sierra (ES); sierras (ES); montagna (IT); montagne (IT)
- hill (EN); hills (EN); heuvel (NL); heuvels (NL); Hügel (DE); Hugel (DE); Huegel (DE); colline (FR); collines (FR); colina (ES); colinas (ES); collina (IT); colline (IT); river (EN); rivers (EN); stream (EN); streams (EN)
- rivier (NL); rivieren (NL); beek (NL); beken (NL); fluss (DE); flüsse (DE); fluesse (DE); fluss (DE); fluß (DE); flüße (DE); strom (DE); ströme (DE); strome (DE); rivière (FR); rivières (FR); ruisseau (FR); ruisseaux (FR); riviere (FR); rivieres (FR); río (ES); ríos (ES); corriente (ES); corrientes (ES); rio (ES); rios (ES); fiume (IT); fiumi (IT); ruscello (IT); ruscelli (IT)
- lake (EN); lakes (EN); meer (NL); meren (NL); see (DE); seen (DE); lac (FR); lacs (FR); lago (ES); lagos (ES); lago (IT); laghi (IT)
- valley (EN); valleys (EN); vallei (NL); valleien (NL); tal (DE); täler (DE); taeler (DE); taler (DE); vallée (FR); vallées (FR); vallee (FR); valees (FR); valle (ES); valles (ES); valle (IT); valli (IT);
- garden (EN); gardens (EN); tuin (NL); tuinen (NL); garten (DE); gardens (DE); jardin (FR); jardins (FR); jardín (ES); jardines (ES); giardino (IT); giardini (IT)
- tree (EN); trees (EN); boom (NL); bomen (NL); baum (DE); bäume (DE); baeume (DE); baume (DE); arbre (FR); arbres (FR); árbol (ES); árboles (ES); arbol (ES); arboles (ES); albero (IT); alberi (IT)
- wood (EN); woods (EN); forest (EN); forests (EN); hout (NL); houten (NL); bos (NL); bossen (NL); holz (DE); hölzer (DE); wald (DE); wälder (DE); hoelzer (DE); holzer (DE); waelder (DE); walder (DE); bois (FR); bois (FR); forêt (FR); forêts (FR); foret (FR); forets (FR); madera (ES); maderas (ES); bosque (ES); bosques (ES); legna (IT); legne (IT); foresta (IT); foreste (IT)
- pastoral (EN); pastorals (EN); pastorale (NL); pastorals (NL); pastoral (DE); Pastorale (DE); pastorale (FR); pastorales (FR); pastoral (ES); pastorales (ES); pastorale (IT); pastorali (IT)
- field (EN); fields (EN); veld (NL); velden (NL); Feld (DE); Felder (DE); champ (FR); champs (FR); campo (ES); campos (ES); campo (IT); campi (IT)
- mill (EN); mills (EN); molen (NL); molens (NL); mühle (DE); mühlen (DE); muehle (DE); muehlen (DE); muhle (DE); muhlen (DE); moulin (FR); moulins (FR); molino (ES); molinos (ES); mulino (IT); mulini (IT)
- meadow (EN); meadows (EN); pasture (EN); pastures (EN); grassland (EN); grasslands (EN); weide (NL); weiden (NL); weiland (NL); weilanden (NL); grasland (NL); grasland (NL); wiese (DE); wiesen (DE); weide (DE); weiden (DE); wiese (DE); wiesen (DE); prairie (FR); prairies (FR); pâturage (FR); pâturages (FR); paturage (FR); paturages (FR); prado (ES); prados (ES); pastar (ES); pastos (ES); pradera (ES); pastizales (ES); prato (IT); prati (IT); pascolo (IT); pascoli (IT); prateria (IT); praterie (IT)
- road (EN); roads (EN); track (EN); tracks (EN); path (EN); pathes (EN); route (EN); routes (EN); weg (NL); wegen (NL); spoor (NL); sporen (NL); pad (NL); pathes (NL); route (NL); routes (NL); straße (DE); straßen (DE); spur (DE); spuren (DE); pfad (DE); wege (DE); route (DE); routen (DE); strasse (DE); strassen (DE); route (FR); routes (FR); piste (FR); pistes (FR); chemin (FR); chemins (FR); route (FR); routes (FR); carretera (ES); carreteras (ES); pista (ES); pistas (ES); camino (ES); pathes (ES); ruta (ES); rutas (ES); strada (IT); strade (IT); traccia (IT); brani (IT); sentiero (IT); sentieri (IT); rotta (IT); rotte (IT)
- spring (EN); summer (EN); autumn (EN); winter (EN); lente (NL); zomer (NL); herfst (NL); winter (NL); frühling (DE); sommer (DE); herbst (DE); Winter (DE); fruehling (DE); fruhling (DE);

printemps (FR); été (FR); l'automne (FR); hiver (FR); ete (FR); primavera (ES); verano (ES); otoño (ES); invierno (ES); otono (ES); primavera (IT); estate (IT); autunno (IT); inverno (IT)
- polder (EN); polders (EN); polder (NL); polders (NL); polder (DE); polders (DE); polder (FR); polders (FR); pólder (ES); pólderes (ES); polderes (ES); polder (IT); polder (IT)
- sunrise (EN); sunset (EN); zonsopkomst (NL); zonsondergang (NL); sonnenaufgang (DE); sonnenuntergang (DE); lever du soleil (FR); coucher du soleil (FR); salida del sol (ES); puesta de sol (ES); alba (IT); tramonto (IT)
- orchard (EN); orchards (EN); boomgaard (NL); boomgaarden (NL); obstgarten (DE); obstgärten (DE); obstgaerten (DE); obstgarten (DE); verger (FR); vergers (FR); huerta (ES); huertos (ES); frutteto (IT); frutteti (IT)
- castle (EN); castles (EN); kasteel (NL); kastelen (NL); schloss (DE); schlösser (DE); schlösser (DE); schlösser (DE); château (FR); châteaux (FR); chateau (FR); chateaux (FR); castillo (ES); castillos (ES); castello (IT); castelli (IT)

Seascape
- sea (EN); seas (EN); seascape (EN); seascapes (EN); zee (NL); zeeën (NL); zeeen (NL); zeegezicht (NL); zeegezichten (NL); meer (DE); meere (DE); seelandschaft (DE); seestück (DE); seestueck (DE); seestücke (DE); seestuecke (DE); mer (FR); mers (FR); paysage marin (FR); paysages marins (FR); mar (ES); mares (ES); marina (ES); paisajes marinos (ES); mare (IT); mari (IT); paesaggio marino (IT); paesaggi marini (IT)
- navy (EN); navies (EN); marine (EN); marines (EN); marine (DE); flotten (DE); Marine (DE); marinesoldaten (DE); marine (FR); marine (FR); marin (FR); marines (FR); marine (NL); marines (NL); marinier (NL); marines (NL); Armada (ES); armadas (ES); marina (ES); infantería de marina (ES); infanteria de marina (ES); Marina Militare (IT); marine (IT); marino (IT); marines (IT)
- ocean (EN); oceans (EN); ozean (DE); ozeane (DE); océan (FR); océans (FR); oceaan (NL); oceans (NL); oceano (ES); oceanos (ES); océanos (ES); oceano (IT); oceani (IT); weltmeer (DE); weltmeere (DE); wereldzee (NL); wereldzeeen (NL)
- ship (EN); ships (EN); ferry (EN); ferries (EN); boat (EN); boats (EN); schip (NL); schepen (NL); veerboot (NL); veerboten (NL); boot (NL); boten (NL); navire (FR); navires (FR); traversier (FR); ferries (FR); bateau (FR); bateaux (FR); schiff (DE); schiffe (DE); fähre (DE); fähren (DE); faehre (DE); faehren (DE); boot (DE); boote (DE); enviar (ES); naves (ES); transportar (ES); transbordadores (ES); barco (ES); barcos (ES); nave (IT); navi (IT); traghetto (IT); traghetti (IT); barca (IT); Barche (IT)
- harbour (EN); harbours (EN); habor (EN); harbors (EN); port (EN); ports (EN); häfen (DE); haefen (DE); hafen (DE); habor (FR); ports (FR); port (FR); ports (FR); habor (NL); havens (NL); haven (NL); havens (NL); habor (ES); puertos (ES); puerto (ES); puertos (ES); habor (IT); porti (IT); porta (IT); porti (IT)
- beach (EN); beaches (EN); shore (EN); shores (EN); strand (NL); stranden (NL); kust (NL); oevers (NL); plage (FR); plages (FR); rive (FR); rivages (FR); strand (DE); strände (DE); straende (DE); ufer (DE); ufer (DE); spiaggia (IT); spiagge (IT); puntellare (IT); sponde (IT); playa (ES); playas (ES); apuntalar (ES); orillas (ES)
- coast (EN); coasts (EN); küste (DE); küsten (DE); kuest (DE); kuesten (DE); kust (NL); kusten (NL); costa (ES); costas (ES); costa (IT); coste (IT); cote (FR); cotes (FR); côte (FR); côtes (FR)

Urbanscape
- city (EN); Stadt (DE); ville (FR); stad (NL); wereldstad (NL); ciudad (ES); città (IT); citta (IT); municipalita (IT); municipalità (IT)
- cities (EN); städte (DE); staedte (DE); villes (FR); steden (NL); ciudades (ES); citta (IT); città (IT)
- village (EN); Dorf (DE); village (FR); dorp (NL); pueblo (ES); villaggio (IT)
- town (EN); stadt (DE); dorf (DE); ville (FR); stad (NL); pueblo (ES); cittadina (IT)
- street (EN); straße (DE); strasse (DE); rue (FR); straat (NL); calle (ES); strada (IT)
- streets (EN); Straßen (DE); strassen (DE); des rues (FR); straten (NL); calles (ES); strade (IT)
- market (EN); markt (DE); marché (FR); marche (FR); markt (NL); mercado (ES); mercato (IT)
- markets (EN); märkte (DE); maerkte (DE); marchés (FR); marches (FR); markten (NL); mercados (ES); mercati (IT)
- church (EN); kirche (DE); église (FR); eglise (FR); kerk (NL); Iglesia (ES); Chiesa (IT)
- cathedral (EN); dom (DE); cathédrale (FR); cathedrale (FR); kathedraal (NL); catedral (ES); cattedrale (IT)

- monastery (EN); kloster (DE); monastère (FR); monastere (FR); klooster (NL); monasterio (ES); monastero (IT)
- monasteries (EN); klöster (DE); kloester (DE); monastères (FR); monasteres (FR); kloosters (NL); monasterios (ES); monasteri (IT)
- usine (EN); usine (DE); usine (FR); usine (NL); Usine (ES); usine (IT)
- factory (EN); fabrik (DE); usine (FR); fabriek (NL); fábrica (ES); fabrica (ES); fabbrica (IT)
- factories (EN); fabriken (DE); usines (FR); fabrieken (NL); suerte (ES); fabbriche (IT)
- house (EN); haus (DE); maison (FR); huis (NL); casa (ES); Casa (IT)
- houses (EN); häuser (DE); haeuser (DE); maisons (FR); huizen (NL); casas (ES); case (IT)
- cottage (EN); hütte (DE); chalet (FR); huisje (NL); cabaña (ES); cottage (IT)
- cottages (EN); hütten (DE); huetten (DE); cottages (FR); huisjes (NL); cabañas (ES); cabanas (ES); cottage (IT)
- maison (EN); maison (DE); maison (FR); maison (NL); maison (ES); Maison (IT)
- maisons (EN); maisons (DE); maisons (FR); maisons (NL); maisons (ES); maisons (IT)
- square (EN); platz (DE); carré (FR); carre (FR); plein (NL); cuadrado (ES); piazza (IT)
- squares (EN); plätze (DE); plaetze (DE); carrés (FR); carres (FR); pleinen (NL); cuadrícula (ES); piazze (IT)
- place (EN); ort (DE); endroit (FR); plaats (NL); lugar (ES); posto (IT)
- places (EN); orte (DE); örter (DE); endroits (FR); plaatsen (NL); lugares (ES); posti (IT)
- canal (EN); kanal (DE); canal (FR); kanaal (NL); canal (ES); canale (IT)
- canals (EN); kanäle (DE); kanaele (DE); canaux (FR); canals (NL); canales (ES); canals (IT)
- channel (EN); kanal (DE); canal (FR); kanaal (NL); canal (ES); canale (IT)
- channels (EN); kanäle (DE); kanaele (DE); canaux (FR); kanalen (NL); canales (ES); canali (IT)
- embankment (EN); Damm (DE); digue (FR); dijk (NL); terraplén (ES); argine (IT)
- embankments (EN); böschungen (DE); boeschungen (DE); remblais (FR); taluds (NL); terraplenes (ES); argini (IT)
- bank (EN); bank (DE); banque (FR); bank (NL); banco (ES); banca (IT)
- banks (EN); banken (DE); banques (FR); banken (NL); bancos (ES); banche (IT)
- station (EN); bahnhof (DE); gare (FR); station (NL); estación (ES); estacion (ES); stazione (IT)
- stations (EN); stationen (DE); stations (FR); stations (NL); estaciones (ES); stazioni (IT)
- gare (EN); gare (DE); gare (FR); gare (NL); gare (ES); gare (IT)
- gares (EN); gares (DE); vêtements (FR); vetements (FR); gares (NL); gares (ES); gares (IT)
- paris (EN); paris (DE); paris (FR); parijs (NL); parís (ES); parigi (IT)
- london (EN); london (DE); londres (FR); londen (NL); londres (ES); londra (IT)
- venice (EN); venedig (DE); venise (FR); venetië (NL); venecia (ES); venezia (IT)
- other 1143 city names in six languages (EN, DE, FR, NL, ES, IT; not tabulated)

Nude

- nude (EN); nudes (EN); nus (FR); nu (FR); naakt (NL); naakten (NL); nackt (DE); akt (DE); akte (DE); nudo (IT); nudi (IT); desnudo (ES); desnudos (ES)

People

- people (EN); gens (FR); Menschen (DE); mensen (NL); gente (ES); persone (IT)
- person (EN); personne (FR); Person (DE); persoon (NL); persona (ES); persona (IT)
- persons (EN); personnes (FR); personen (DE); personen (NL); personas (ES); persone (IT)
- family (EN); famille (FR); familie (DE); familie (NL); familia (ES); famiglia (IT)
- families (EN); familles (FR); familien (DE); gezinnen (NL); familias (ES); famiglie (IT)
- boy (EN); garçon (FR); garcon (FR); Junge (DE); jongen (NL); chico (ES); ragazzo (IT)
- boys (EN); garçons (FR); garcons (FR); Jungen (DE); jongens (NL); chicos (ES); ragazzi (IT)
- girl (EN); fille (FR); mädchen (DE); maedchen (DE); meisje (NL); niña (ES); nina (ES); ragazza (IT); girls (EN); filles (FR); mädchen (DE); maedchen (DE); meisjes (NL); chicas (ES); ragazze (IT)
- man (EN); homme (FR); mann (DE); man (NL); hombre (ES); uomo (IT)
- men (EN); hommes (FR); männer (DE); mannen (NL); hombres (ES); uomini (IT)
- woman (EN); femme (FR); frau (DE); vrouw (NL); mujer (ES); donna (IT)
- women (EN); femmes (FR); frauen (DE); vrouwen (NL); mujeres (ES); donne (IT)
- child (EN); enfant (FR); kind (DE); kind (NL); niño (ES); nino (ES); bambino (IT)
- children (EN); enfants (FR); kinder (DE); kinderen (NL); niños (ES); ninos (ES); bambini (IT); couple (EN); couple (FR); paar (DE); paar (NL); pareja (ES); coppia (IT)
- couples (EN); couples (FR); paare (DE); koppels (NL); parejas (ES); coppie (IT)

- mother (EN); mère (FR); mere (FR); mutter (DE); moeder (NL); madre (ES); madre (IT)
- mothers (EN); mères (FR); meres (FR); mütter (DE); muetter (DE); moeders (NL); madres (ES); madri (IT)
- father (EN); père (FR); pere (FR); vater (DE); vader (NL); padre (ES); padre (IT)
- fathers (EN); pères (FR); peres (FR); väter (DE); vaeter (DE); vaders (NL); padres (ES); padri (IT)
- lady (EN); dame (FR); dame (DE); dame (NL); dama (ES); signora (IT)
- ladies (EN); dames (FR); damen (DE); dames (NL); señoras (ES); senoras (ES); signore (IT); gentleman (EN); messieurs (FR); herren (DE); mijne heren (NL); caballeros (ES); gentiluomini (IT)
- gentelmen (EN); messieurs (FR); Herren (DE); mijne heren (NL); caballeros (ES); gentiluomini (IT)
- sir (EN); madam (EN); herr (DE); frau (DE); monsieur (FR); madame (FR); mijnheer (NL); Mevrouw (NL); señora (ES); senora (ES); señor (ES); senor (ES); corso (IT); signore (IT)

Self Portrait

- self-portrait (EN); self portrait (EN); selbstporträt (DE); selbstportraet (DE); selbstbildnis (DE); selbstportrat (DE); autoportrait (FR); auto portrait (FR); auto-portrait (FR); zelfportret (NL); zelfportret (NL); zelf-portret (NL); zelf portret (NL); auto retrato (ES); auto-retrato (ES); autorretrato (ES); auto-ritratto (IT); auto ritratto (IT); autoritratto (IT)

Portrait

- portrait (EN); portraits (EN); porträt (DE); porträts (DE); portraet (DE); portraets (DE); portrait (FR); portraits (FR); portret (NL); portretten (NL); retrato (ES); retratos (ES); ritratto (IT); ritratti (IT)
- face (EN); faces (EN); gesicht (DE); gesichter (DE); anblick (DE); visage (FR); visages (FR); cara (ES); caras (ES); viso (IT); facce (IT); gezicht (NL); gezichten (NL)

Religion

- jesu (EN); jesus (DE); jésu (FR); jesu (NL); jesu (ES); jesu (IT)
- jesus (EN); jesus (DE); jésus (FR); jezus (NL); jesús (ES); gesù (IT)
- christ (EN); christus (DE); christ (FR); christus (NL); cristo (ES); cristo (IT)
- agnus dei (EN); agnus dei (DE); agnus dei (FR); lam gods (NL); lam god (NL); cordero de dios (ES); agnello di dio (IT)
- spirit (EN); geist (DE); esprit (FR); geest (NL); espíritu (ES); spirito (IT)
- spirits (EN); spirituosen (DE); esprits (FR); spiritualiën (NL); espíritu (ES); spiriti (IT)
- lamb of god (EN); lamm gottes (DE); agneau de dieu (FR); lam van god (NL); cordero de dios (ES); agnello di dio (IT)
- god (EN); gott (DE); dieu (FR); god (NL); dios (ES); dio (IT)
- gods (EN); götter (DE); dieux (FR); goden (NL); gallinero (ES); dio (IT)
- saviour (EN); savior (EN); retter (DE); sauveur (FR); heiland (NL); salvador (ES); salvatore (IT)
- redeemer (EN); erlöser (DE); rédempteur (FR); verlosser (NL); redentor (ES); redentore (IT)
- saviors (EN); erretter (DE); sauveurs (FR); redders (NL); salvadores (ES); salvatori (IT);
- redemption (EN); erlösung (DE); rachat (FR); verlossing (NL); redención (ES); salvación (ES); redenzione (IT)
- eden (EN); eden (DE); eden (FR); eden (NL); edén (ES); eden (IT)
- judgement (EN); beurteilung (DE); urteil (DE); jugement (FR); oordeel (NL); juicio (ES); giudizio (IT)
- father (EN); vater (DE); père (FR); vader (NL); padre (ES); padre (IT)
- apostle (EN); apostel (DE); apôtre (FR); apostel (NL); apóstol (ES); apostolo (IT)
- apostles (EN); apostel (DE); apôtres (FR); apostelen (NL); apóstoles (ES); apostoli (IT);
- angel (EN); engel (DE); ange (FR); engel (NL); ángel (ES); angelo (IT)
- angels (EN); engel (DE); anges (FR); angels (NL); ángeles (ES); angeli (IT)
- holy (EN); heilig (DE); saint (FR); heilig (NL); santo (ES); santo (IT)
- sacred (EN); heilig (DE); sacré (FR); heilig (NL); sagrado (ES); sacro (IT)
- saint (EN); heilige (DE); saint (FR); heilige (NL); smo (ES); santo (IT)
- saints (EN); heilige (DE); saints (FR); heiligen (NL); santos (ES); santi (IT)
- madonna (EN); madonna (DE); madone (FR); madonna (NL); virgen (ES); madonna (IT); mere de dieu (FR); moeder gods (NL); mutter gottes (GE); madre de dios (ES); madre di dio (IT)
- mary magdalene (EN); maria magdalena (DE); mary magdalene (FR); maria magdalena (NL); maría magdalena (ES); maria maddalena (IT)
- annunciation (EN); verkündigung (DE); annonciation (FR); aankondiging (NL); anunciación (ES); annunciazione (IT);

- annonciation (EN); annonciation (DE); annonciation (FR); annonciation (NL); annonciation (ES); annonciation (IT)
- adoration (EN); anbetung (DE); verehrung (DE); adoration (FR); aanbidding (NL); adoración (ES); adorazione (IT)
- worship (EN); anbetung (DE); culte (FR); aanbidden (NL); rendir culto (ES); culto (IT)
- adam and eve (EN); adam und eva (DE); adam et eve (FR); adam en eva (NL); adán y eva (ES); adam e eve (IT)
- crucifixion (EN); kreuzigung (DE); crucifixion (FR); kruisiging (NL); crucifixión (ES); crocifissione (IT)
- last supper (EN); das letzte abendmahl (DE); dernière cène (FR); laatste avondmaal (NL); última cena (ES); ultima cena (IT)
- emmaus (EN); emmaus (DE); Emmaüs (FR); emmaus (NL); emmaus (ES); emmaus (IT); Emaús (Portuguese)
- eucharist (EN); abendmahl (DE); eucharistie (FR); eucharistie (NL); eucaristía (ES); eucaristia (IT)
- cross (EN); kreuz (DE); traverser (FR); kruis (NL); cruzar (ES); attraversare (IT)
- descend from the cross (EN); vom Kreuz absteigen (DE); descendre de la croix (FR); afstammen van het kruis (NL); descender de la cruz (ES); discendere dalla croce (IT); descente de croix (FR);
- deposition from the cross (EN); absetzung vom Kreuz (DE); déposition de la croix (FR); depositie van het kruis (NL); deposición de la cruz (ES); deposizione dalla croce (IT)
- maesta (EN); maesta (DE); maesta (FR); maesta (NL); maesta (ES); maesta (IT)
- lamentation (EN); wehklage (DE); lamentation (FR); weeklacht (NL); lamentación (ES); amento (IT)
- lamentations (EN); klagen (DE); lamentations (FR); klaagliederen (NL); lamentaciones (ES); Lamentazioni (IT)
- lament (EN); klage (DE); complainte (FR); weeklacht (NL); lamento (ES); lamento (IT)
- nativity (EN); geburt (DE); nativité (FR); geboorte (NL); natividad (ES); nativit à (IT);
- birth (EN); geburt (DE); naissance (FR); geboorte (NL); nacimiento (ES); nascita (IT)
- magi (EN); weisen (DE); magi (FR); magi (NL); los reyes magos (ES); magi (IT)
- kings (EN); könige (DE); rois (FR); kings (NL); reyes (ES); re magi (IT)
- temptation (EN); versuchung (DE); tentation (FR); verleiding (NL); tentación (ES); tentazione (IT)
- temptations (EN); versuchungen (DE); tentations (FR); verleidingen (NL); tentaciones (ES); tentazioni (IT)
- assuption (EN); assusion (DE); assomption (FR); assuption (NL); assuption (ES); assuption (IT); ten hemel opname (NL); tenhemelopname (NL)
- heaven (EN); Himmel (DE); paradis (FR); hemel (NL); cielo (ES); Paradiso (IT)
- hell (EN); hölle (DE); enfer (FR); hel (NL); infierno (ES); inferno (IT)
- ascencion (EN); ascencion (DE); ascencion (FR); ascencion (NL); ascensión (ES); ascencion (IT); hemelvaart (NL); himmelfahrt (GE)
- whitsun (EN); pfingsten (DE); pentecôte (FR); pinksteren (NL); whitsun (ES); pentecoste (IT)
- easter (EN); ostern (DE); pâques (FR); pasen (NL); pascua de resurrección (ES); pasqua (IT)
- christmas (EN); weihnachten (DE); noël (FR); kerstmis (NL); navidad (ES); natale (IT)
- biblical (EN); biblisch (DE); biblique (FR); bijbels (NL); bíblico (ES); biblico (IT)
- egypt (EN); ägypten (DE); egypte (FR); egypte (NL); egipto (ES); egitto (IT)
- samarit (EN); samarit (DE); samarit (FR); samarit (NL); samarit (ES); samarit (IT)
- samaritan (EN); samariter (DE); samaritain (FR); samaritano (IT); samaritano (ES); samaritaan (NL)

Still Life

- still life (EN); stillleben (DE); nature morte (FR); stilleven (NL); naturaleza muerta (ES); bodegón (ES); bodegon (ES); natura morta (IT)
- vase (EN); vase (DE); vase (FR); vaas (NL); florero (ES); jarrón (ES); jarron (ES); vaso (IT)
- vases (EN); vasen (DE); vases (FR); vazen (NL); floreros (ES); vasi (IT)
- fruit (EN); obst (DE); frucht (DE); fruit (FR); fruit (NL); fruta (ES); frutta (IT)
- fruits (EN); früchte (DE); fruechte (DE); fruits (FR); fruit (NL); frutas (ES); frutta (IT)
- apple (EN); apfel (DE); pomme (FR); appel (NL); manzana (ES); Mela (IT)
- apples (EN); äpfel (DE); aepfel (DE); pommes (FR); appels (NL); manzanas (ES); mele (IT)
- apricot (EN); aprikose (DE); abricot (FR); abrikoos (NL); albaricoque (ES); albicocca (IT)
- apricots (EN); aprikosen (DE); abricots (FR); abrikozen (NL); albaricoques (ES); albicocche (IT)
- lemon (EN); zitrone (DE); citron (FR); citroen (NL); limón (ES); limon (ES); limone (IT)
- lemons (EN); zitronen (DE); citrons (FR); citroenen (NL); limones (ES); limoni (IT)

- orange (EN); orange (DE); orange (FR); oranje (NL); naranja (ES); arancia (IT)
- oranges (EN); orangen (DE); oranges (FR); sinaasappels (NL); naranjas (ES); arance (IT)
- grape (EN); traube (DE); grain de raisin (FR); grume (FR); druif (NL); uva (ES); uva (IT)
- grapes (EN); trauben (DE); raisins (FR); druiven (NL); uvas (ES); uva (IT)
- pear (EN); birne (DE); poire (FR); peer (NL); pera (ES); pera (IT)
- pears (EN); birnen (DE); poires (FR); peren (NL); peras (ES); pere (IT)
- flower (EN); blume (DE); fleur (FR); bloem (NL); flor (ES); fiore (IT)
- flowers (EN); blumen (DE); blüte (DE); bluete (DE); fleurs (FR); bloemen (NL); flores (ES); fiori (IT)
- rose (EN); rose (DE); rose (FR); roos (NL); rosa (ES); rosa (IT)
- roses (EN); rosen (DE); roses (FR); roses (NL); rosas (ES); Rose (IT)
- tulip (EN); tulpe (DE); tulipe (FR); tulp (NL); tulipán (ES); tulipano (IT)
- tulips (EN); tulpen (DE); tulipes (FR); tulpen (NL); tulipanes (ES); tulipani (IT)
- bottle (EN); flasche (DE); bouteille (FR); fles (NL); botella (ES); bottiglia (IT)
- bottles (EN); flaschen (DE); bouteilles (FR); flessen (NL); botellas (ES); bottiglie (IT)
- butterfly (EN); schmetterling (DE); papillon (FR); vlinder (NL); mariposa (ES); farfalla (IT)
- butterflies (EN); schmetterlinge (DE); papillons (FR); vlinders (NL); mariposas (ES); farfalle (IT)
- flora (EN); flora (DE); flore (FR); flora (NL); flora (ES); flora (IT)
- floral (EN); blumen (DE); floral (FR); bloemen (NL); floral (ES); floreale (IT)
- plant (EN); pflanze (DE); plante (FR); fabriek (NL); planta (ES); pianta (IT)
- plants (EN); pflanzen (DE); plantes (FR); planten (NL); plantas (ES); piante (IT)
- vegetable (EN); gemüse (DE); gemuese (DE); légume (FR); legume (FR); groente (NL); vegetal (ES); verdura (IT)
- vegetables (EN); gemüse (DE); gemuese (DE); légumes (FR); legumes (FR); groenten (NL); vegetales (ES); verdure (IT)

Study

- study (EN); studie (DE); étude (FR); etude (FR); studie (NL); estudiar (ES); studia (IT); studio (EN); estudio (ES); studio (DE); studio (FR); studio (IT); studio (NL)

Untitled

- untitled (EN); ohne titel (DE); sans titre (FR); untitled (NL); zonder titel (NL); intitulado (ES); sin título (ES); sin titulo (ES); senza titolo (IT)