**Investment Returns and Economic Fundamentals in International Art Markets**

Renneboog, L.D.R.; Spaenjers, C.

Publication date:
2014

**INVESTMENT RETURNS AND ECONOMIC FUNDAMENTALS
IN INTERNATIONAL ART MARKETS**

By

Luc Renneboog, Christophe Spaenjers

24 February, 2014

# Investment Returns and Economic Fundamentals

# in International Art Markets

Luc Renneboog

CentER, Tilburg University

and

Christophe Spaenjers[*]

HEC Paris

**Abstract:[1]**

Works of art are neither easily tradable across borders, nor evaluated according to globally identical standards. We examine geographical segmentation and its effects on price formation and returns in the international art auction market. We find (i) a close connection between the country of sale and the type (e.g., nationality) of artworks sold; (ii) substantial international variation in average returns to art investments over the period 1971-2007; (iii) an impact of both global and local GDP growth and equity returns on national art market returns. Local fundamentals have not lost importance over time, despite increased economic integration (especially between the EU countries). Yet, country-specific economic factors matter less in determining the auction outcomes for high-end art. Our findings suggest the continuing importance of international demand differences in shaping the global art market, at least outside the top segment.

**JEL Codes:** Z11, G15

**Keywords:** Economics of art, art markets, home bias, geographical market segmentation, art auctions, hedonic regression

---

[*] Luc Renneboog (luc.renneboog@tilburguniversity.edu) is at CentER, Tilburg University, P.O. Box 90153, 5000 LE Tilburg, the Netherlands. Christophe Spaenjers (spaenjers@hec.fr) is at HEC Paris, 1 rue de la Libération, 78351 Jouy-en-Josas, France.

# Investment Returns and Economic Fundamentals

# in International Art Markets

## 1. Introduction

Art markets are segmented geographically in two different but mutually reinforcing ways. First, practical and legal barriers hinder international art transactions. As an extreme example, some countries impose restrictions on the export of certain categories of art, which of course negatively affects demand and prices (Onofri 2009). But even if not outlawed, international art trade may still be discouraged by import tariffs and transport costs that also induce a home (country) bias in the consumption of other goods (Obstfeld and Rogoff 2001), or by transaction costs resulting from the localized nature of art markets' institutional frameworks. Even mere distance from the sale matters, since it can be hard for a potential buyer to adequately assess a work without physically inspecting it.

Second, art is a heterogeneous good, and its market is also partially segmented because of international variation in the relative demand for different types of art. Most importantly, for many artists' output, the demand will be the highest in their home country, as collectors generally seem to prefer art from compatriots. In recent years, this has been particularly obvious in emerging markets such as China, India, and Russia, where the new rich are buying back their heritage (e.g., Renneboog and Spaenjers 2011). However, survey evidence indicates that a home bias in taste is also relevant in developed economies. To give just one example, 47% of the Finns interviewed by the Dia Center for the Arts (1997) indicated that they prefer Finnish art over art from other countries. Building on the ideas of Stigler and Becker (1977) and Adler (1985), Schulze (1999) argues that the ''cultural discount'' with respect to unfamiliar foreign art can be explained by international differences in ''consumption capital''—accumulated past consumption—and by the importance of information exchange with one's peers in building up this capital. Related to the issues of social networks and art buyers' consumption accumulation, it is interesting to point out that art institutions and events worldwide overrepresent domestic

artists,[2] which could be related to the necessity of strong personal ties between artists, dealers, and collectors (Velthuis 2013) and to the geographical embeddedness of gatekeepers and cultural policies (Van Hest 2012).

Both if art owners find it difficult to sell art internationally, or if supply easily crosses borders and adjusts to international variation in demand, we can expect cross-country differences in the characteristics of the art that is being traded. Moreover, if it is much easier to buy art locally, or if auctions cater to local preferences, we can hypothesize a relationship between the price of art sold in a country on the one hand and the state of its economy on the other hand. Prior research has not investigated the relevance of such forms of geographical segmentation in the art auction market. Most existing research on art investments constructs a single universal price index, often largely based on auction sales in London or New York—see, for example, Goetzmann (1993) and Mei and Moses (2002).[3] This chapter therefore has multiple purposes. First, we discuss the international variation in artworks sold at auction. Second, we estimate the returns in international art markets since the early 1970s, and examine to which extent art prices generated in different auction markets move together. Third, we assess the relative importance of global (i.e., worldwide) and local (i.e., country-specific) economic "fundamentals" in determining art prices.

To study art market segmentation and its impact on price formation and returns, we start from a unique database containing information on more than one million transactions of paintings and works on paper at auctions worldwide over the last decades. In this chapter, we focus on the 13 developed countries for which we record at least 10,000 sales at auction since 1970. The data set reveals substantial segmentation in terms of the type of artworks sold. Many artists have a large majority of their sales in just one country. Furthermore, in many countries, the number of sales of domestic works far outnumbers that of other nationalities.

Next, after constructing novel art price indexes for each country, we find cross-country variation

---

[2] Recent research (e.g., Quemin 2006; Van Hest 2012; Quemin 2013; Velthuis 2013) also shows the continuing dominance of a limited number of Western countries in the international art market.

[3] Two studies that relate to the issue of segmentation deserve mentioning. Ginsburgh and Jeanfils (1995) examine price comovement between three important auction locations. Pesando (1993) studies violations of the law of one price in the market for prints. However, these papers do not directly investigate differences in returns and the reasons for these differences.

in investment performance, despite the global economic and financial cycles affecting all art markets. The average correlation in art returns between countries is not higher than that in international equity returns, suggesting that national factors matter as much for the pricing of artworks as for company valuations. Average deflated U.S. dollar (USD) returns between the early 1970s and 2007 range from –0.90% (Belgium) to 4.60% (U.K.). In all countries, the average return on art is below the return to equities over the same period, and in most countries it is even below the average GDP growth rate.

We then turn to studying what economic fundamentals drive returns in international art markets. As non-monetary motives dominate financial considerations among buyers of art and other collectibles (Burton and Jacobsen 1999; Barclays 2012), the performance of art as an *investment* may largely depend on wealthy households' demand for luxury *consumption*. Accordingly, Hiraki et al. (2009) and Goetzmann et al. (2011) show how art prices are affected by changes in equity wealth and in top incomes. This chapter adds to this evidence by showing that international art markets share considerable exposure to worldwide equity market trends and aggregate economic growth. This finding can explain why most art markets suffered after the global economic downturns in the mid-1970s and in the early 1980s, 1990s, and 2000s. However, art prices are also partially set locally: same-country equity returns and economic growth have much statistical power in explaining art returns. Interestingly, we do not find evidence that the art markets considered in this chapter have become more integrated over time, despite the globalization of the world economy, suggesting the importance of persistent international differences in demand. As expected, however, we find that local fundamentals matter less for high-end art, which is more likely to appeal to universally shared preferences (and for which transportation and other fixed transaction costs should matter less).

This chapter proceeds as follows. Section 2 presents our data and identifies systematic patterns in the distribution of art sales across countries. Section 3 estimates art returns for our set of countries, and discusses the international variation in investment performance. Section 4 relates local art market trends to global and local economic fundamentals and explores when local factors are more important. Section 5 concludes.

## 2. Art Auctions around the World

The data for this chapter come from the database constructed in Renneboog and Spaenjers (2013). The authors first rely on different authoritative art history resources to compile an exhaustive list of 10,211 artists. They then look up all auction sales of paintings, watercolors, and drawings by these artists in the Art Sales Index, an online resource. Next to prices (exclusive of transaction costs), the Art Sales Index also provides some details on the work (e.g., medium, size) and the sale (e.g., location, date) for each transaction. The final data set contains 1,088,709 observations from 1957 until 2007. As in most databases, buy-ins (i.e., items that do not reach the reserve price) are not included.

Only London sales are included until 1969, but the coverage of the data set is very broad since 1970. A majority of all sales took place outside the London or New York offices of Sotheby's and Christie's; many hundreds of auction houses are included. However, most auction houses considered are located in developed economies, and even in those countries the data may miss out on the smallest auction houses and the lowest sales prices. Finally, it is important to note that we do not have any data on transactions in the dealer market, which is less transparent than the auction market. We may thus be considering the part of the art market that is the least likely to be affected by segmentation, in which case the patterns that we document can be expected to be more pronounced "out of sample".[4]

Over the last 25 years of the studied time frame, the average number of observations per year is around 35,000. The mean sales price over all observations for 2007—the last year of our sample period—is 159,354 USD, while the median transaction price for the same year equals 14,775 USD. A comparison of the total annual value of these sales to the turnover of the fine art auction market suggests that the database represents a substantial portion of the market, especially in recent years. For example, a review by Artprice (2008) reports a total fine art auction turnover of 6.4 billion USD for 2006—an estimate that should itself be considered as a lower bound on the true turnover—while the total sales value for the same year in the data set used here equals 4.6 billion USD.

---

[4] One could also expect segmentation to be potentially more important in contemporary art than in older artworks, for example because interactions with collectors are crucial for an artist who has not established his reputation yet. However, we do not have sufficient data to examine this issue.

We categorize all sales by country, based on the currency of the sale and the location of the auction house. For 13 different countries, we record more than 10,000 sales: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Italy, the Netherlands, Sweden, Switzerland, the U.K., and the U.S. We focus on these countries as from now. The first columns of Table 1 show the number of observations for each sample country. Not surprisingly, most sales information is available for the U.K. (333,973 observations), and for the U.S. (216,896).

[Insert Table 1 about here]

Even in public sales, the identity and location of the buyer and the seller are typically kept secret by the auction house. Nevertheless, the data hint at a degree of segmentation in two different but related ways. First, more than 40% of all artists for whom we record at least two transactions have three quarters or more of their sales in just one country. Striking examples include Edward Hopper and Georgia O'Keeffe who account for about 200 observations each, all in the U.S. However, there are also many artists whose sales cluster outside the U.K. or the U.S. For example, 605 of the 618 sales of art by Max Ackermann took place in Germany, and 86% of the more than 2,000 transactions of Sidney Nolan works occurred in Australia.

Second, we have information on the nationality of all post-Renaissance artists classified in one or more art movements by Renneboog and Spaenjers (2013). Based on this information, about 40% of all sales in our sample can be classified as works by a Belgian, French, German, Italian, Dutch, Spanish, U.K., or U.S. artist. (These are the eight largest nationality groups in the data set. When an artist has a double nationality, we use the country of residence during his adult life.) The largest nationality-based subsample is that of French art (168,476 sales). Table 1 shows the distribution of sales over nationalities for each country. In Belgium, France, Germany, Italy, and the Netherlands, the number of sales of domestic works far outnumbers that of other nationalities. For example, the data set includes 68,518 sales of French works at French auction houses, but only 544 sales of British art in France. The relative importance of domestic art is substantially lower in the U.K. and the U.S., the largest art markets. Yet, if we look at Table 1 from a different perspective, we also see that more than 80% of British and American art is sold domestically. The data thus indicate a close connection between the location of the sale and the type of art sold, in line with our expectations.

Our data do not tell us whether barriers to trade hinder the supply of artworks to spread internationally, or whether supply is adjusting to the international variation in demand. However, the clustering of sales in the U.K. and the U.S., and the anecdotal evidence that internationally operating auction houses optimize the sale location in function of local demand,[5] suggest that barriers to trade cannot be the full story. In the next two sections of this paper, we will also show that we find little evidence of increasing integration over time, even as barriers to trade have gone down, pointing to a role for persistent differences in demand.

## 3. Returns in International Art Markets

To construct a (universal) price index for art, most prior research has applied either a repeat sales estimator (Pesando 1993; Goetzmann 1993; Mei and Moses 2002) or a hedonic regression (Buelens and Ginsburgh 1993; Chanel et al. 1996; Ashenfelter and Graddy 2003; Renneboog and Spaenjers 2013) to a data set of auction sales. Repeat sales regressions estimate returns based on purchase-and-sale price pairs of objects that trade more than once. The method provides a near-perfect control for quality, but often implies the use of small and selective data sets. By contrast, a hedonic regression can use all available sales information. It regresses transaction prices on a range of price-determining hedonic characteristics (e.g., reputation of the artist, medium and size of the work, etc.) and a set of time dummies. The changes in the coefficients on the time dummies then measure returns, under the assumption that the time-invariant quality (or appeal) of each individual work is captured by the hedonic characteristics (Ashenfelter and Graddy 2003).

Our data set includes detailed information on a very large number of auction sales, but does not identify multiple transactions of the same item. We therefore use hedonic regressions to estimate an annual art price index, in real USD terms, for each country that we consider. The hedonic characteristics included are the same as in Renneboog and Spaenjers (2013), and relate to the artist, the artwork itself, and the location and timing of the sale. More details on our methodology and on the exact specification and estimation of our model can be found in Appendix A at the end

---

[5] For example, in 2000, Christie's Russian art specialist said in an interview that Russian buyers in London "are more interested in Russian cloisonne and paintings, which is why we sell them in London. In New York the market is more international, especially for Russian silver and objects by Faberge" (The New York Times, 2000).

of this chapter.

Table 2 shows the average, the standard deviation, and the minimum and maximum of the distribution of (log) returns over the longest available uninterrupted time frame for each country. The table also includes the average real GDP growth and equity return in those countries over the same periods. Logged and deflated USD-denominated GDP growth rates and equity returns are taken from Global Financial Data.

[Insert Table 2 about here]

We find substantial variation in investment performance across countries. The average real USD returns on art, over the three to four decades leading up to 2007, range from −0.90% (Belgium) to 4.60% (U.K.). For the U.S., it equals 3.07%. In most cases, the average return on art is lower than the average GDP growth, and in all cases it remains below the average equity return.

Table 2 indicates that there is cross-sectional variation in return volatility as well. However, there is no clear correlation between risk and return. The highest standard deviations are recorded for Australia (21.15%) and Sweden (20.18%), whereas the lowest volatility is observed in Germany (13.12%). The relatively small standard deviation for the U.S. (14.31%) may not be a surprise (at least if art prices are not entirely set globally), given that we consider returns in USD. The reported volatilities for art are of the same order of magnitude as those of the equity markets in the sample. (Moreover, we should note that, due to the time aggregation of sales data, the raw standard deviations still underestimate the true riskiness of art investments (Working 1960; Renneboog and Spaenjers 2013).)

Despite the cross-country variation in long-term returns, art markets often display similar movements. Table 2 shows that 1991 was a bad year for international art markets: average art prices in France, Sweden, Switzerland, the U.K., and the U.S. dropped by between 29% and 61%. Many low returns were also recorded in 1981. Most art markets delivered their strongest returns either in 1972–1973 or in the second half of the 1980s.

Figure 1 presents the resulting price indices for the five largest art markets over our time period: France, Italy, the Netherlands, the U.K., and the U.S. In all cases, the log index value in 1970 is set equal to one. The plots confirm previous observations on both the cross-sectional variation in

performance—over the full time frame, but also at any point in time—and the cyclical behavior of international art markets. On average, art prices increased in the early 1970s, the late 1980s, and in the last years of our sample period. Art markets suffered after 1973 and in the early 1980s, 1990s, and 2000s, which were recessionary periods in most developed economies.

[Insert Figure 1 about here]


To further investigate the comovement between the art price indices, we calculate pairwise return correlation coefficients. The results can be found in Table 3. All coefficients are significantly positive at the 0.05 level, except the correlation between Australia and Switzerland. However, also in some other cases, the correlations are remarkably low. For example, the correlations between the returns in Austria or Germany on the one hand and those in the U.S. on the other are below 0.50. In contrast, art returns in the U.K. and the U.S.—traditionally the countries with the largest shares of international consignors and bidders, as large auction houses typically offer the most expensive works in London or New York—show a pairwise correlation coefficient of 0.84.

[Insert Table 3 about here]


The average of the cross-country correlation coefficients in Table 3 amounts to 0.59. This exceeds the mean correlation in international property markets of about 0.40 reported by Case et al. (1999) over a shorter period. Due to the immobility of houses, real estate markets are of course defined more locally than art markets. The average correlation between international art markets is, however, almost identical to that between the international equity markets in our sample (0.58). This suggests that country-specific factors matter as much for pricing artworks as for pricing companies. (In the next section, we will examine the relative importance of local factors in determining returns in more depth.) Moreover, based on two different convergence measures (i.e., the cross-sectional dispersion of national returns and the average covariance of returns with U.S. returns), we do not find conclusive evidence that the integration of international art markets has increased over time (not reported).

**4. Economic Fundamentals in International Art Markets**

*4.1. Global and Local Fundamentals*

One of the conclusions of the previous section was that international art markets exhibit roughly similar time series patterns. Before turning to country-specific factors, we therefore examine to which degree art price changes in the sample countries can be explained by global economic fundamentals alone. We focus on two potentially important drivers of art prices for which data are widely available: GDP growth rates and equity returns. As explained before, there exists strong evidence of stock market wealth effects on the consumption of art (Hiraki et al. 2009; Goetzmann et al. 2011). We also consider GDP in our analysis because both cross-country and time-series variation in economic growth have been shown to affect the demand for art (Schulze 1999; Mandel 2014). Furthermore, it plays an important role in determining the returns in international real estate markets (Case et al. 1999). Housing is a durable asset category that, like art, has both investment and consumption characteristics.

We take a series of global GDP growth rates from the World Bank. As a proxy for worldwide movements in stock prices, we use Global Financial Data's capitalization-weighted World Return Index.[6] We then do a pooled regression of all art returns—there are between 34 and 37 annual observations since 1971 per country—against these two factors. The results can be found in the first row of Table 4.

[Insert Table 4 about here]

The regression results in Table 4 show that variation in worldwide economic growth impacts the price of art. We find that the sensitivity of art prices to income growth rates is higher than one. This backs up previous assertions that art is a superior consumption good (Pommerehne and Feld 1997; Mandel 2014). Lagged global equity returns also have a substantial effect on art returns in many countries; the coefficient of 0.33 is significantly higher than zero. The global GDP growth

---

[6] In line with prior research, we use lagged equity returns, because the equity returns are calculated at year ends, while the art index aggregates information per calendar year (just like GDP). Moreover, there may be a lag between shocks to stock market wealth and art consumption, since most auction houses only hold sales every few months.

rates and equity returns explain slightly more than 30% of the variation in art market returns. Such an explanatory power lies in line with prior research—see, for example, Goetzmann et al. (2011). Still, there is scope for identifying other factors that play a role in art pricing. Adding local factors should simultaneously allow us to explain more of the variation in art returns, and to gauge the relative importance of global versus local fundamentals.

Rather than adding the raw local GDP growth rates and equity returns to the previous regression, we first orthogonalize each local fundamental with respect to the global factor. In other words, we regress the time series of each local fundamental (e.g., growth of Australian GDP) on the data for the global factor (e.g., growth of global GDP), and consider the resulting residuals—representing local trends not explained by global trends—as a country-specific factor.

The second row of Table 4 shows the results when adding these newly-constructed orthogonal local factors to our model. The global variables remain statistically significantly positive. Yet, the results also show that local economic growth and wealth creation play a significant role in setting local art prices, even when controlling for global trends.

We can quantitatively evaluate the importance of the local fundamentals by comparing the explanatory power of our new model to that of the previous model, which only included global factors. Overall, local factors add about 15 percentage points to the R-squared of the model, which is equivalent to a proportional increase of 48%. So even though global factors are more important, local fundamentals help explaining art market returns in an economically significant way. In other words, art prices are to a substantial degree set locally.[7]

### 4.2. Cross-Country and Time-Series Variation in the Importance of Local Fundamentals

Running our regressions on countries individually shows international variation in the increase in R-squared after adding local factors (not reported). Local deviations from global economic trends are thus more important for some countries than for others. Remarkably, two of the three

---

[7] Our main results are robust to a wide range of alternative index construction methodologies and model specifications. For example, desmoothing the art indexes, using repeat sales regressions (on a subsample of the data matched on artworks' characteristics) instead of hedonic regressions, changing the currency perspective from USD to local currencies, or controlling for (global and local) changes in inflationary expectations or the income distribution, leads to very similar results (not reported).

countries with the largest changes in explanatory power are Australia and Italy. These markets are arguably the ones most affected by distance from other countries and legal provisions (at least for older artworks), respectively. The increase in R-squared is much smaller for the more internationally-oriented art markets (Switzerland, U.K., and U.S.). Of course, it is also the case that the highest-quality works are more likely to be sold in well-integrated economies (cf. infra).

It is conceivable that the importance of local fundamentals has decreased over time, as the world economy has become more globalized, and barriers to trade have fallen. However, if we run our regressions separately for the years since 1990 and the years before, we do not find that the additional explanatory power of local factors has gone down (not reported). So, as before, we cannot conclude that the market for the art that we consider in this chapter has become less segmented. This finding suggest that persistent international differences in demand, which interact with variation in economic fundamentals, continue shaping the global art market.

*4.3. Art Quality and the Importance of Local Fundamentals*

Local factors should play a smaller role in determining the price level of art by the most highly reputable artists, which is often appreciated universally (and for which fixed transaction and transportation costs should matter less). To test this hypothesis, we split our sample into three groups, based on the length of the entry for each artist in the online encyclopedia Oxford Art Online. A first subsample includes the top decile of all sales, in terms of biography word count. The other two subsamples contain the remaining above-median-quality and the below-median-quality sales.[8] We then re-estimate our return series for each country and for each quality category. The results (not reported) show a positive relation between quality and long-term returns: higher-quality art has appreciated in value much faster over our time frame than low-quality art. We then examine the importance of global and local factors for each quality category by repeating the regression models presented before. Table 5 presents the results. We find that local deviations from global trends have no statistically significant impact on art prices for works by the most highly reputable artists. The contribution of the local factors to the

---

[8] The differences in the average price level across these three groups are economically significant. In 2007, the average price in the U.S. of a piece in the top-quality category was 1,453,096 USD, compared to 474,778 USD and 110,595 USD for the other two categories.

explanatory power of each model is inversely related to average artist quality.[9] Furthermore, the coefficients on the global factors are higher for higher-quality art. This larger sensitivity, especially to global stock markets, could partially explain the higher financial returns to better art in recent decades.

[Insert Table 5 about here]

## 5. Conclusion and Discussion

Works of art are neither easily tradable across borders, nor evaluated according to globally identical standards. This chapter examines geographical segmentation and its effects on price formation and returns in the international art auction market. Based on unique data on art auctions in 13 developed countries, we come to the following conclusions. First, there is a close connection between the country of sale and the type (e.g., nationality) of artworks sold. Second, we find substantial international variation in average returns to art investments over the period 1971-2007. Third, national art market returns are impacted by global GDP growth and equity returns, but also by economic growth and stock market trends in the country considered. For the markets studied here, we do not find evidence that local fundamentals have lost importance over time, despite economic integration (especially between the E.U. countries) and advances in technology. Yet, country-specific economic factors matter less in determining the auction outcomes for high-end art.

We argue that, taken together, our findings suggest the continuing importance of international demand differences in shaping the global art market, at least outside the top segment. However, we cannot rule out that there still exist hard-to-quantify barriers to international trade that are unrelated to variation in preferences. Both a quantitative study of the determinants of international art flows and a more qualitative analysis of the barriers to cross-border art purchases can probably shed light on how relevant search and transaction costs still are in today's art market.

---

[9] Interestingly, we find a similar result if we split the sample in the sales at Christie's and Sotheby's on the one hand and those at other auction houses on the other hand. These auction houses are of course more likely to sell high-quality artists, but additionally they may be better in advertising their sales internationally.

**Appendix A. Estimation of Art Returns**

Our hedonic regression model is given by the following equation:

$$\ln P_{kt} = \alpha + \sum_{m=1}^{M} \beta_m X_{mkt} + \sum_{t=1}^{T} \delta_t D_{kt} + \varepsilon_{kt},$$

where $P_{kt}$ represents the price of good $k$ at time $t$, $X_{mkt}$ is the value of hedonic characteristic $m$ of object $k$ at time $t$, and $D_{kt}$ is a time dummy variable which takes a value of one if good $k$ is sold in year $t$ (and zero otherwise). The coefficients $\beta_m$ reflect the attribution of a shadow price to each of the $m$ variables that control for variation in quality. The estimated log return in year $t$, $r_t$, is equal to $\delta_t - \delta_{t-1}$. (One time dummy is left out; the slope coefficient is set equal to zero for this base period.)

All auction prices are translated to deflated USD, using monthly U.S. CPI data, prior to applying the hedonic regression. In order to capture the properties of the artist, the work, and the sale, our regression model includes the following hedonic variables:

- *Textbook dummy*. To obtain an exogenous proxy for artist reputation, five different editions (1926, 1959, 1980, 1996, and 2004) of the classic art history textbook 'Gardner's Art Through the Ages' were consulted. Slightly less than 10% of all considered artists are included in this resource at some point. The variable TEXTBOOK equals one if the artist features in the last edition prior to the sale.

- *Attribution dummies*. Attribution can be an important factor that influences prices, especially of older art objects. The different types of attribution used in this study—reflecting different levels of relationships between master and pupil (or follower)—are: ATTRIBUTED (to), STUDIO (of), CIRCLE (of), SCHOOL (of), AFTER, and (in the) STYLE (of).

- *Authenticity dummies*. SIGNED and DATED works may impart a premium, because there is less uncertainty about their authenticity.

- *Medium dummies*. Average price levels vary across techniques. We therefore include the variables OIL, WATERCOLOR, and DRAWING.

- *Size*. The height and width in inches are represented by HEIGHT and WIDTH, with the squared values being HEIGHT_2 and WIDTH_2.

- *Topic dummies*. Renneboog and Spaenjers (2013) create the following categories, based on the first word(s) of the title: ABSTRACT, ANIMALS, LANDSCAPE, NUDE, PEOPLE, PORTRAIT, RELIGION, SELF-PORTRAIT, STILL_LIFE, UNTITLED, and URBAN. Furthermore, the dummy STUDY equals one if the title contains either "study" or "étude".

- *Month dummies*. Important sales are often clustered in time, and therefore we include the variables JANUARY to DECEMBER.

- *Auction house dummies*. For Sotheby's and Christie's, we introduce dummy variables for their London, New York, and other sales (e.g., SOTH_LONDON, SOTH_NY, and SOTH_OTHER). For Bonhams and Phillips, two other important British auction houses, we distinguish between London and other locations. We also include two dummies that account for the sales by reputable European and American auction houses.

The descriptive statistics of these variables for the original data set are shown and discussed in Renneboog and Spaenjers (2013). Our hedonic model is estimated using ordinary least squares for each country separately. The log return estimates are computed as the first differences of the coefficients on the year dummies. However, we exclude the time dummy coefficients for country-year combinations with less than 50 observations in order to ensure that the reported returns are representative. Also, we do not consider the pre-1971 returns for the U.K., to enable a meaningful comparison across countries.

**References**

Adler, Moshe. 1985. "Stardom and talent." *American Economic Review* 75 (1): pp. 208–212.

Artprice. 2008. "Art market trends 2007." http://img1.artprice.com/pdf/trends2007.pdf.

Ashenfelter, Orley, and Kathryn Graddy. 2003. "Auctions and the price of art." *Journal of Economic Literature* 41 (3): pp. 763–787.

Barclays. 2012. "Profit or pleasure? Exploring the motivations behind treasure trends." *Barclays Wealth Insights Volume 15*.

Buelens, Nathalie, and Victor Ginsburgh. 1993. "Revisiting Baumol's 'art as floating crap game'." *European Economic Review* 37 (7): pp. 1351–1371.

Burton, Benjamin J., and Joyce P. Jacobsen. 1999. "Measuring returns on investments in collectibles." *Journal of Economic Perspectives* 13 (4): pp. 193–212.

Case, Bradford, William Goetzmann, and K. Geert Rouwenhorst. 1999. "Global real estate markets: Cycles and fundamentals." Working paper, Yale International Center for Finance.

Chanel, Olivier, Louis-André Gérard-Varet, and Victor Ginsburgh. 1996. "The relevance of hedonic price indices." *Journal of Cultural Economics* 20 (1): pp. 1–24.

Dia Center for the Arts. 1997. "The most wanted paintings on the web." http://awp.diaart.org/km/index.html.

Ginsburgh, Victor, and Philippe Jeanfils. 1995. "Long-term comovements in international markets for paintings." *European Economic Review* 39 (3-4): pp. 538–548.

Goetzmann, William N. 1993. "Accounting for taste: Art and the financial markets over three centuries." *American Economic Review* 83 (5): pp. 1370–1376.

Goetzmann, William N., Luc Renneboog, and Christophe Spaenjers. 2011. "Art and money." *American Economic Review (Papers and Proceedings)* 101 (3): pp. 222–226.

Hiraki, Takato, Akitoshi Ito, Darius A. Spieth, and Naoya Takezawa. 2009. "How did Japanese investments influence international art prices?" *Journal of Financial and Quantitative Analysis* 44 (6): pp. 1489–1514.

Mandel, Benjamin R. 2014. "Investment in the visual art: Evidence from international transactions." In *Handbook of the Economics of Art and Culture (Volume 2)*, edited by Victor

A. Ginsburgh and David Throsby, pp. 233–260. Elsevier/North-Holland.

Mei, Jianping, and Michael Moses. 2002. "Art as an investment and the underperformance of masterpieces." *American Economic Review* 92 (5): pp. 1656–1668.

Obstfeld, Maurice, and Kenneth Rogoff. 2001. "The six major puzzles in international macroeconomics: Is there a common cause?" In *NBER Macroeconomics Annual 2000*, edited by Ben S. Bernanke and Kenneth Rogoff, pp. 339–412. MIT Press.

Onofri, Laura. 2009. "Old master paintings, export veto and price formation: An empirical study." *European Journal of Law and Economics* 28 (2): pp. 149–161.

Pesando, James E. 1993. "Art as an investment: The market for modern prints." *American Economic Review* 83 (5): pp. 1075–1089.

Pommerehne, Werner W., and Lars P. Feld. 1997. "The impact of museum purchase on the auction prices of paintings." *Journal of Cultural Economics* 21 (3): pp. 249–271.

Quemin, Alain. 2006. "The illusion of an international contemporary art scene without borders: The positions of different countries in 'the age of globalization and mixing'." *International Sociology* 21 (4): pp. 523–551.

Quemin, Alain. 2013. "International contemporary art fairs in a 'globalized art market'." *European Societies* 15 (2): pp. 162–177.

Renneboog, Luc, and Christophe Spaenjers. 2011. "The iconic boom in modern Russian art." *Journal of Alternative Investments* 13 (3): pp. 67–80.

Renneboog, Luc, and Christophe Spaenjers. 2013. "Buying beauty: On prices and returns in the art market." *Management Science* 59 (1): pp. 36–53.

Schulze, Günther G. 1999. "International trade in art." *Journal of Cultural Economics* 23 (1-2): pp. 109–136.

Stigler, George J., and Gary S. Becker. 1977. "De gustibus non est disputandum." *American Economic Review* 67 (2): pp. 76–90.

The New York Times, 2000. "Collecting Russian treasures." 15 December 2000.

Van Hest, Femke. 2012. *Territorial Factors in a Globalised Art World?* Doctoral thesis, Erasmus

University Rotterdam.

Velthuis, Olav. 2013. "Globalization of markets for contemporary art." *European Societies* 15 (2): pp. 290–308.

Working, Holbrook. 1960. "Note on the correlation of first differences of averages in a random chain." *Econometrica* 28 (4): pp. 916–918.

## Table 1. Frequency of sales by country and nationality

Table 1 shows the total number of observations by sample country and the distribution of sales over the largest nationality groups. The last column contains the sales for which the artist's nationality is either not among those shown or unknown. All art data come from the Art Sales Index.

| Country | Total | Nationality of artist | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Belgian | French | German | Italian | Dutch | Spanish | U.K. | U.S. | Other / unknown |
| Australia | 29,656 | 22 | 97 | 16 | 42 | 59 | 11 | 165 | 25 | 29,219 |
| Austria | 15,601 | 879 | 561 | 673 | 1,165 | 1,525 | 66 | 91 | 76 | 10,565 |
| Belgium | 15,007 | 6,228 | 969 | 56 | 150 | 781 | 45 | 50 | 120 | 6,608 |
| Canada | 14,685 | 56 | 352 | 24 | 66 | 141 | 23 | 232 | 133 | 13,658 |
| Denmark | 22,676 | 431 | 481 | 166 | 188 | 909 | 48 | 53 | 101 | 20,299 |
| France | 162,996 | 4,004 | 68,518 | 1,472 | 5,282 | 5,766 | 2,759 | 544 | 2,697 | 71,954 |
| Germany | 63,621 | 1,299 | 3,585 | 18,122 | 1,481 | 3,267 | 291 | 309 | 1,262 | 34,005 |
| Italy | 49,653 | 757 | 2,140 | 644 | 18,216 | 967 | 365 | 259 | 650 | 25,655 |
| Netherlands | 39,651 | 3,203 | 1,246 | 435 | 391 | 11,939 | 62 | 64 | 147 | 22,164 |
| Sweden | 31,357 | 609 | 1,339 | 394 | 641 | 1,674 | 135 | 210 | 316 | 26,039 |
| Switzerland | 38,247 | 981 | 6,030 | 2,194 | 1,342 | 2,456 | 369 | 252 | 737 | 23,886 |
| U.K. | 333,973 | 13,756 | 44,292 | 7,123 | 22,588 | 24,322 | 5,291 | 32,592 | 4,829 | 179,180 |
| U.S. | 216,896 | 3,791 | 36,658 | 4,731 | 8,844 | 8,012 | 4,533 | 4,982 | 53,229 | 92,116 |

## Table 2. Distribution of art returns per country

Table 2 shows some characteristics (average, standard deviation, minimum, and maximum) of the distribution of art returns per country, measured over the longest available time frame. The table also includes the averages of the GDP growth rates and the equity returns over the same periods. All variables are USD-denominated, deflated, and logged.

| Country | Time frame | Art returns | | | | | | Avg. GDP growth | Avg. equity return |
|---------|-----------|------|------|------|------|------|------|-----------------|---------------------|
| | | Avg. | S.D. | Min. | | Max. | | | |
| Australia | 1971-2007 | 3.09% | 21.15% | -40.40% | 1975 | 66.66% | 1973 | 3.91% | 7.56% |
| Austria | 1971-2007 | 2.53% | 17.44% | -38.40% | 1981 | 37.76% | 2007 | 4.11% | 5.66% |
| Belgium | 1975-2007 | -0.90% | 17.41% | -44.30% | 1975 | 38.57% | 1986 | 2.02% | 8.42% |
| Canada | 1972-2007 | 2.36% | 16.12% | -27.19% | 1983 | 28.31% | 2004 | 3.03% | 5.91% |
| Denmark | 1976-2007 | 1.75% | 15.56% | -41.96% | 1981 | 29.66% | 1987 | 2.70% | 9.58% |
| France | 1971-2007 | 1.14% | 18.94% | -61.03% | 1991 | 39.74% | 1986 | 3.50% | 8.00% |
| Germany | 1971-2007 | 1.52% | 13.12% | -28.08% | 1981 | 25.87% | 1986 | 1.43% | 5.44% |
| Italy | 1971-2007 | 1.99% | 17.67% | -41.80% | 1976 | 36.66% | 1986 | 3.68% | 6.75% |
| Netherlands | 1971-2007 | 2.30% | 17.94% | -44.26% | 1981 | 48.74% | 1973 | 4.13% | 8.14% |
| Sweden | 1971-2007 | 2.32% | 20.18% | -55.16% | 1991 | 44.56% | 1987 | 2.65% | 10.51% |
| Switzerland | 1972-2007 | 1.99% | 18.50% | -38.99% | 1991 | 75.63% | 1972 | 3.41% | 7.30% |
| U.K. | 1971-2007 | 4.60% | 15.79% | -38.66% | 1991 | 30.47% | 1987 | 3.88% | 7.94% |
| U.S. | 1971-2007 | 3.07% | 14.31% | -28.73% | 1991 | 33.58% | 1973 | 2.53% | 6.19% |

**Table 3. Pairwise correlations between art returns**

Table 3 shows the pairwise correlations between the art returns of different countries. All coefficients are significantly different from zero at the 0.05 level, except the correlation between Australia and Switzerland. All returns are USD-denominated, deflated, and logged. More information on the distribution of art returns per country can be found in Table 2.

| Country | Australia | Austria | Belgium | Canada | Denmark | France | Germany | Italy | Netherlands | Sweden | Switzerland | U.K. | U.S. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | - | | | | | | | | | | | | |
| Austria | 0.49 | - | | | | | | | | | | | |
| Belgium | 0.41 | 0.68 | - | | | | | | | | | | |
| Canada | 0.66 | 0.43 | 0.34 | - | | | | | | | | | |
| Denmark | 0.43 | 0.65 | 0.60 | 0.41 | - | | | | | | | | |
| France | 0.55 | 0.69 | 0.66 | 0.53 | 0.70 | - | | | | | | | |
| Germany | 0.34 | 0.75 | 0.69 | 0.48 | 0.67 | 0.77 | - | | | | | | |
| Italy | 0.47 | 0.69 | 0.61 | 0.56 | 0.46 | 0.80 | 0.72 | - | | | | | |
| Netherlands | 0.46 | 0.61 | 0.72 | 0.41 | 0.74 | 0.64 | 0.54 | 0.49 | - | | | | |
| Sweden | 0.52 | 0.50 | 0.47 | 0.56 | 0.76 | 0.75 | 0.70 | 0.59 | 0.64 | - | | | |
| Switzerland | 0.27 | 0.47 | 0.49 | 0.52 | 0.59 | 0.73 | 0.66 | 0.55 | 0.40 | 0.64 | - | | |
| U.K. | 0.69 | 0.67 | 0.65 | 0.64 | 0.78 | 0.87 | 0.60 | 0.67 | 0.63 | 0.68 | 0.67 | - | |
| U.S. | 0.71 | 0.46 | 0.50 | 0.64 | 0.60 | 0.77 | 0.39 | 0.55 | 0.56 | 0.64 | 0.54 | 0.84 | - |

**Table 4. Global and local fundamentals**

The first row of Table 4 shows the results of the ordinary least squares estimation of a regression model with art returns as the dependent variable, and global GDP growth rates and lagged equity returns (and a constant) as independent variables. The data for all countries are pooled, and standard errors (in parentheses) are clustered by year. More information on the distribution of art returns per country can be found in Table 2. The second row adds orthogonalized local GDP growth rates and lagged equity returns as independent variables. The orthogonal factors are the residuals from country-specific regressions of the time series of local GDP growth rates and equity returns against the global equivalents. All variables are USD-denominated, deflated, and logged. Regression coefficients that are significantly different from zero at the 0.10, 0.05, and 0.01 level are indicated by *, **, and ***, respectively. The last columns show the adjusted R-squared for each model, and the proportional increase in R-squared between the two models.

| Model | N | Global | | Local | | $R^2$ | $\Delta_p R^2$ |
| | | GDP | Equities | GDP | Equities | | |
|---|---|---|---|---|---|---|---|
| Global only | 473 | 1.35 *** | 0.33 ** | | | 0.31 | |
| | | (0.23) | (0.12) | | | | |
| Global and local | 473 | 0.64 *** | 0.32 *** | 0.62 *** | 0.13 ** | 0.46 | 0.48 |
| | | (0.21) | (0.09) | (0.10) | (0.05) | | |

**Table 5. Art quality and the importance of local fundamentals**

Table 5 repeats the analysis reported at the bottom of Table 4, using new country-specific return series for three different quality categories. All transactions are first ranked according to the length of the artist's biography in the online art history resource Oxford Art Online. Then three categories are created based on the word count deciles: top quality (decile 1), medium quality (deciles 2-5), and low quality (deciles 6-10).

| Quality category | N | Global | | | | Local | | | | $R^2$ | $\Delta_p R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GDP | | Equities | | GDP | | Equities | | | |
| Top quality | 180 | 0.74 | ** | 0.61 | *** | 0.23 | | 0.07 | | 0.25 | 0.02 |
| | | (0.36) | | (0.15) | | (0.14) | | (0.11) | | | |
| Medium quality | 445 | 0.63 | ** | 0.35 | *** | 0.63 | *** | 0.14 | ** | 0.36 | 0.49 |
| | | (0.24) | | (0.10) | | (0.11) | | (0.06) | | | |
| Low quality | 464 | 0.63 | *** | 0.27 | *** | 0.62 | *** | 0.12 | ** | 0.44 | 0.57 |
| | | (0.19) | | (0.09) | | (0.09) | | (0.05) | | | |

**Figure 1. Art price indices for France, Italy, the Netherlands, the U.K., and the U.S.**

This figure shows the log art price index values (in real USD) for the five largest art markets. The indices are set equal to one in 1970. More information on the distribution of art returns per country can be found in Table 2.