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Abstract:

This paper investigates the prices and the returns in the market for modern Russian art, a prime example of an 'emerging art market', over the last four decades. After applying a hedonic regression model on an extensive dataset containing 52,154 sales by 410 Russian artists, we show that the reputation of the artist, the strength of the attribution, and the topic of the work play important roles in the price formation of Russian art, in addition to characteristics such as size, medium and the identity of the auction house. We find a geometric average return of 4.07%, in real USD terms, between 1967 and 2007. Since 1997, however, our Russian art index shows an annualized return of 12.40%, which is roughly double the average yearly appreciation of a global art market index over the same period. Especially nineteenth century Russian art has generated high returns. Based on correlations and Granger causality tests, we conclude that the prices for Russian art are impacted by both Russian and global stock market movements. Our results illustrate how the new wealth created in fast-developing economies has its impact on the market for art from these countries.

JEL classification: D44, F0, G1, Z11.

Keywords: Alternative investments; Art; Auctions; Emerging markets; Hedonic regressions; Wealth.

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1. Introduction

There is a large and expanding literature on the return characteristics of art in general, and of paintings, prints, and drawings in specific.[1] This growing financial scrutiny of the investment opportunities in the art market is driven by the following factors. First, the growing number of art objects selling at very high prices (frequently above USD one million) is continually drawing media attention to the art market. Second, the increased availability of data makes a more accurate financial analysis of the art markets possible. The third and most important factor, however, is the impressive expansion of the population of "high net worth individuals". These very wealthy people often consider converting part of their financial assets into art and other "investments of passion" (Cap Gemini 2008). This evolution has entailed the creation of art advisory services within financial institutions or as independent consultancies.

Over the past decade, the growth in wealth of investors from emerging markets has outstripped that of individuals in the more developed countries (Cap Gemini 2008). The inflow of these new collectors in the art market has reportedly made this market more stable than before (Financial Times 2008). Indeed, after the credit crunch in 2007 and 2008, the decrease in the price level in the art market was softened by a wave of new acquisitions by buyers from China, the Middle East, Russia, and India (The Economist 2008). (A recent news report specifically mentions the impact of Russian money: "Super-rich Russians have been one reason for the disconnect between the financial crisis gripping the world and soaring prices for top works of art" (Reuters 2008a).) To date, virtually no empirical research on the price formation of art from these economies exists has been performed, despite the conventional art market wisdom that art buyers have a passion for buying art of their own country.[2] To our knowledge, Kraeussl

[1] For example, Goetzmann (1993), Mei and Moses (2002), and Renneboog and Spaenjers (2009) have studied the long-term returns on art, using different auction sales data sets. For more general overviews of the existing literature on art auctions, prices, and price indices, see Ashenfelter and Graddy (2003) and Ginsburgh et al. (2006). In a recent addition to the literature, Mandel (2008) uses a consumption asset pricing model to give a theoretical foundation for the relatively low observed returns on art investments.

[2] It is notoriously hard to find information on who buys what in the art market, since auction houses do not reveal buyers' identities. However, anecdotical evidence and auction house reports suggest that art buyers, especially from emerging markets, have a clear preference for art works from their own countries. For example, in 2004, Business Week wrote: "With the emergence of free-spending, nouveau riche collectors from mainland China, the Chinese art market is at the start of what may be an extended boom. Buyers are snatching up everything from 3,000-year-old bronze vessels to avant-garde paintings by Chinese-born artists living in China and abroad." Similarly, Reuters (2008b) stated that from 2005 to 2007 "salerooms buzzed with anticipation as Russian buyers fought for precious pieces of their heritage".

and Logher (2008), who look into the investment performance of Russian, Chinese, and Indian art over different but short time frames, are the only authors that have focused on emerging art markets before.[3]

If this is true that art investors exhibit home bias, then one would expect stronger price rises in the art from emerging markets than in art from the so-called developed economies, at least over the past decade. Therefore, in this paper, we focus on the returns on Russian art over a period of four decades. Russia, one of the four so-called BRIC countries, has seen its real GDP grow at an average of about 7% per year since 2000 to become the 8th largest economy (based on GDP) of the world. Simultaneously, the country has brought forward a remarkably large number of dollar billionaires (Forbes 2008),[4] and some of the world's most important art collectors (ARTnews 2008). Russia also makes an interesting case because of its rich history of visual arts: important waves in modern Russian visual arts are Realism (e.g. Serov, Perov, Repin, and other members of the so-called Wanderers) and Russian avant-garde (e.g. Malevich, Kandinsky, Chagall, Archipenko).

We apply an hedonic pricing framework to an extensive dataset containing more than 52,000 sales by 410 Russian artists, and build a price index for modern Russian art (oil paintings, prints, and works on paper). We find an annualized real return between 1967 and 2007 of 4.07%. In the last 10 years of our period, the average return was much higher (12.40%), mainly thanks to very large price increases for nineteenth century Russian art. Our Russian art index has clearly outperformed a global art market index since 1997. The Russian stock market has done very well over the same period (at least since 2000), which has led to a strong growth in the available wealth in the hands of Russian individuals (and to growth in Russian nationalism, which may also matter here). Clearly, Russian art has turned out to be one outlet for this newly acquired wealth. That the art market is impacted by the stock market is confirmed by the results of Granger causality tests.

This paper contributes to the literature in different respects. First, our time frame is significantly longer that of Kraeussl and Logher (2008), and therefore our study deepens the understanding of the long-term historical performance of art from emerging markets. Second, we are able to look into the differences in art price trends between the art market in general and an important emerging art market. Third, this study illustrates the combined impact of the home bias of art investors and a 'wealth creation effect'[5] in practice.

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[3] Kraeussl and Logher (2008) use the hedonic regression technique to construct price indices. They report geometric annual returns of 10.00% between 1985 and 2008 for Russia, 5.70% between 1990 and 2008 for China, and 42.20% between 2002 and 2008 for India. The authors also use the constructed price indices to investigate the portfolio diversification benefits of investments in emerging art markets, but find limited diversification potential.

[4] 19 individuals on the 2008 Forbes Top 100 list of richest people in the world were Russian.

[5] Goetzmann (1993) is one of the studies to present evidence of a causal relationship from stock prices to art prices.

The rest of this short paper is structured as follows. Section 2 describes the data and methodology. The baseline results are outlined in Section 3, while Section 4 contains a number of robustness checks. Section 5 shows how the taste for different categories of Russian art has changed over the last two decades. The returns on art are compared to those on financial assets in Section 6. The same section also investigates the impact of stock market movements on the art market. The final section concludes.

2. Data and methodology

In a first step, we were provided with a very extensive list of more than 500 Russian[6] artists by MacDougall's Auctioneers, a London-based auction house which specializes in Russian art. The artists considered are mainly from the second half of the nineteenth or from the twentieth century. We thus not consider earlier Russian art, such as icons, which is a different market with its own dynamics. Since the focus of this paper is on artists whose work can (and has) been sold through 'Russian sales' at auction houses, the list also includes artists from Russian descent, and artists who were born outside of Russia but lived and worked in the country throughout their whole adult life. However, based on biographical information, we did exclude a small number of artists, whose connection with Russia is very limited, from the original list. On the other hand, we added about twenty Russian artists included in the study by Renneboog and Spaenjers (2009) to the list, in order to have an as comprehensive starting point as possible.

Secondly, we look up all the sales of oil paintings, prints, and works on paper in the Art Sales Index, an online database which contains more than three million public auction records since the middle of the previous century.[7] The Art Sales Index focuses on London sales until 1969, but it has very comprehensive worldwide coverage for the next four decades. We have data until the fall of 2007. We find 52,154 sales for 410 different artists. The number of sales per calendar year are listed in Panel A of Table 1. The first observation in our dataset is the May 1954 sale of a painting by Alexei Harlamoff, at Christie's London, for GBP 260. The last available data stem from the November 2007 auctions, and include some high-profile sales by Chaim Soutine, Wassily Kandinsky, and Marc Chagall at Sotheby's New York. Although we can only find data on a limited number of transactions in early years of our time

[6] Typically, 'Russian' is defined very broadly in the art market. Geographically, the term includes artists or art from the whole former Soviet Republic, including countries like Ukraine.

[7] The Art Sales Index is accessible at http://www.artinfo.com/artsalesindex. The prices in the Art Sales Index are hammer prices, exclusive of transaction costs, which can amount to 25% on a round trip. Historically, the Art Sales Index has not included buy-ins, which implies that we only observe prices that exceed the reserve price. This should not make much of a difference over the long period we are considering here.

frame, we record information on much more observations starting from the end of the 1960s. The artists with the largest number of sales are listed in Panel B of Table 1. As becomes clear from the table, the most frequently sold artist in our dataset is Marc Chagall, with 6,973 observations. The most expensive transaction in our database (both in nominal and real terms) is the sale of Wassily Kandinsky's "Fugue", which was auctioned for more than 19 million USD in May 1990, at Sotheby's New York.[8]

[Insert Table 1 about here]

Thirdly, and finally, in order to construct a price index, we closely follow the hedonic pricing methodology as outlined in Renneboog and Spaenjers (2009). Hedonic regressions control for quality changes in the transacted goods by attributing implicit prices to specific value-adding characteristics. A time dummy can then capture the pure time effect – and thus be used to build a quality-adjusted hedonic price index. Formally, a (semilog) hedonic regression can be represented as follows:

$$\ln P_{kt} = \sum_{m=1}^{M} \alpha_m X_{mkt} + \sum_{t=1}^{T} \beta_t \delta_{kt} + \varepsilon_{kt} \qquad (1),$$

where P_{kt} represents the price of good k at time t, X_{mkt} is the value of characteristic m of object k at time t and δ_{kt} is a time dummy variable which takes the value 1 if good k is sold in period t (and 0 otherwise). The coefficients α_m reflect the attribution of a shadow price to each of the m characteristics, while the (antilogs of the) coefficients β_t are used to construct a hedonic price index.

We will calculate the art returns by relating the natural logs of the real USD prices to year dummies (δ) while controlling for a wide range of independent variables (X) that capture the characteristics of the artist, of the work, and of the sale. In addition to the artist dummies capturing each artist's uniqueness, we also include the following hedonic variables:

- *Artist deceased at time of sale*. The dummy variable DECEASED equals one when the creator of the art object is not alive anymore at the time of the sale. It is sometimes argued that the death of an artist causes a shift in the price level of his work.

[8] The 1914 Kandinsky painting came from the Solomon R. Guggenheim's collection, just like Chagall's "Anniversaire", which was auctioned the same evening (The New York Times 1990). Also included in the record-breaking sale was Renoir's "Moulin de la Galette", still the second most expensive painting of all time in real terms. Nowadays, the most expensive work of Russian art is Kazimir Malevich's "Suprematist Composition", which was sold for 53.5 million USD (excluding transaction costs) in November 2008, again at Sotheby's New York (The New York Times 2008).

- *Attribution dummies*. The level of attribution may play an important role in the price formation of (older) art objects. Therefore, we include the dummy variables ATTRIBUTED (to), STUDIO (of), CIRCLE (of), SCHOOL (of), AFTER, and (in the) STYLE (of).
- *Authenticity dummies*. We want to investigate whether SIGNED, DATED, and INSCRIBED works sell at a premium compared to works which lack visible evidence of genuineness.
- *Medium dummies*. We introduce dummies for the different medium categories included in this study: OIL, PRINT, and PAPER. The last category includes gouaches, drawings, watercolors, etc.
- *Size*. It is well known that size matters in the pricing of art object. In this study, the height and width in inches are represented by HEIGHT and WIDTH, with the squared values being HEIGHT^2 and WIDTH^2.
- *Topic dummies*. We categorize the art works in different topic groups based on the first word(s) of the title. We create the following eleven topic categories, based on the search strings that can be found in Appendix 1: ABSTRACT, ANIMALS, LANDSCAPE, NUDE, PEOPLE, PORTRAIT, RELIGION, SELF-PORTRAIT, STILL_LIFE, UNTITLED, and URBAN. Furthermore, we create a dummy STUDY that equals one if the title contains the words "study" or "etude".
- *Auction house dummies*. Especially in the higher end of the market, the art market is almost a duopoly. Therefore, for the two biggest auction houses (Sotheby's and Christie's), we introduce dummy variables for the sales in their London, New York, and other offices (e.g. SOTH_LONDON, SOTH_NY, and SOTH_OTHER). These variables can partially proxy for the quality of the work, since Sotheby's and Christie's sell most of the best works in any category.
- *Month dummies*. Since important auctions, which include the best works up for sale in a season, are often scheduled at the end of the spring or the beginning of the winter, we include dummies that indicate the month of the sale, going from JANUARY to DECEMBER.

The descriptive statistics for these hedonic variables are exhibited in Table 2. For the dummy variables, we show the number of zeros and ones. For the variables HEIGHT and WIDTH, the mean values and standard deviations are presented.

[Insert Table 2 about here]

3. Results

We now estimate the hedonic regression outlined in equation (1) using ordinary least squares. We include year dummies, artist dummies, and all the hedonic variables presented in the previous section. To

avoid multicollinearity we leave out one artist dummy, the year dummy 1967,[9] the medium dummy OIL, and the month dummy JUNE. The results for the hedonic variables are shown in Table 3. The table shows the coefficient (with the standard deviation and the t-statistic), and the equivalent price impact for each variable. The latter percentage is calculated as the exponent of the coefficient, minus one.

[Insert Table 3 about here]

Considering the coefficient on DECEASED, we find no upward price shift, which goes again the conventional wisdom that the prices for an artist are higher after his death. However, the result is in line with the empirical evidence presented in Renneboog and Spaenjers (2009). Note that is still possible that the death of an artist only temporarily lifts the prices for his work to a higher level (Ekelund et al. 2000), or that dead artists are in general more valuable than living artists (because of a preference for older art). As could be expected, the coefficients on all attribution dummies are significantly negative, implying that the market values originality. For example, works that are from the "circle" or "school" of an artist sell for about 70% less than works by the real master. This appreciation of authenticity is also confirmed by the positive coefficients on the variables SIGNED and DATED. A signature adds about 22% to the value of a work. When an art object bears a date, its value is (on average and ceteris paribus) 10% higher than that of a non-dated object. Prints and works on paper clearly trade at a sizeable discount compared to oil paintings. The large negative coefficient on PRINT can be explained by the fact that most prints are not unique. The results on the size variables HEIGHT and WIDTH show that the price of a piece increases with the size of the work. The fact that the squared variables are negative indicates that there are limits to the size of auctioned art. Regarding the topic dummies, we see the lowest prices for STUDIES and UNTITLED. These results are not a surprise. Also the relatively large discount for PORTRAITS is in line with previous findings: portraits are often of little value once they leave the family of the person depicted. In contrast, we see a clear premium for ABSTRACT works. The coefficients on the auction house dummies show that the highest price levels for Russian art have been reached at Sotheby's London and New York, and Christie's London. Finally, the month dummies show that, in general, the highest prices are reached in the months May, June, November, and December, which indeed is when the most important sales traditionally take place.

Since the model also includes artist dummies, we can evaluate which artists have in general been the most valuable ones over the last four decades. We find the highest artist dummy coefficients (not

[9] We leave out the year dummy 1967, because we start our Russian art index in that year (cf. infra).

reported) for (in decreasing order): Wassily Kandinsky, El Lissitzky, Chaim Soutine, Marc Chagall, and Kazimir Malevich. This is not really a surprise, given the high reputation of these artists. (Kandinsky, Malevich, and Lissitzky are the three artists in our dataset with the longest entries, i.e. biographies, in the authoritative Oxford Art Online database. Chagall has the 9th highest word count; Soutine is still in the first decile.)

We now turn to the coefficients on the time dummies. When we take the exponent of each coefficient, and equate the resulting index value in 1967 to 100, we get the Russian art index outlined in Panel A of Table 4. Even though we have information on transactions since 1954, we start our index in 1967, since there are very few observations in the first few years of our time frame. Also, choosing 1967 as our base year allows us to analyze price trends over a period of four decades exactly. Panel B shows the annualized return per decade since 1967, and over the whole time frame. It also includes a comparison with the global art index of Renneboog and Spaenjers (2009), which covers the whole art market. Figure 1 graphically depicts the Russian art index constructed in this paper and the global art index.

[Insert Table 4 and Figure 1 about here]

We see that Russian art on average has increased by 4.07% per year, in real USD terms. However, there are large differences in mean returns over time. From Panel A of Table 4, we learn that Russian art has greatly appreciated in value in the beginning of the 1970s, at the end of the 1980s, and between 2001 and 2007. This is broadly in line with general art market trends, as also evidenced by Figure 1. While the geometric annualized returns of the Russian art market are negative for the period 1987-1997 (see Panel B), they are significantly higher for the two surrounding decades. Especially the high average return between 1997 and 2007 is remarkable: 12.40%, compared to 6.08% on the global art index.[10] Figure 1 shows that, while the two indices have generally shown the same trends, Russian art has clearly outperformed the overall art market since the start of the new century.

4. Sample selection and survivorship issues

Even though we argue that our list of Russian artists and the resulting dataset are extremely extensive, and thus representative for the Russian art market, we perform a number of robustness checks to mitigate

[10] The whole art market, including the market for Russian art, has slowed down somewhat in 2008, but the global public auction turnover was still higher in 2008 than in the years preceding 2007 (Artprice.com 2009).

concerns about sample selection and survivorship issues that may have put an upward bias on our results. More specifically, we repeat the hedonic regression analysis outlined in the previous section, and rebuild our art price index, starting from on a number of different subsamples of our overall dataset. First, since a large part of the list of artists considered in this study is received from an art market player, we may have sample selection concerns. Therefore, we limit the list to the artists included in Renneboog and Spaenjers (2009), who construct their list of artists using a wide array of art history resources.[11] As a second check, we only consider artists who already have sales observations in the first 25 years of our data set (1954-1978), to accommodate concerns about a potential 'backward-filled data bias' (Mei and Moses 2002), in the sense that we may be focusing on artists in vogue at the time of the research. Third, and last, we limit the analysis to observations for which the artist was dead at the time of the transaction, hereby eliminating the possibility that our index overstates true price trends because of the inclusion of living artists who are still building a career (a literal survivor bias). It is important to stress that all potential issues outlined here would put an upward bias on the baseline results. The average annualized real returns for these subsamples are reported in Table 5.

[Insert Table 5 about here]

The results in Table 5 show that we do not seem to significantly overestimate the returns because of sample selection or survivorship issues. The returns are very close to the baseline results for the three different subsamples considered.

5. Changing tastes

It is well known that every submarket in the art market has its own dynamics. This may be especially relevant in the context of Russian art, given the profound changes in the Russian political (and cultural) system in the last two decades. In this section, we compare the returns on art from three different periods:[12] (i) art from the nineteenth century, the time of the unthreatened tsarist imperial Russia;[13] (ii) art created in the period 1900-1935, the years around the Russian revolution and the thriving period of the

[11] Renneboog and Spaenjers (2009) employ the Oxford Art Online encyclopedia, the Artcyclopedia.com website, the 1989 textbook 'Modern Art' edited by David Britt, and a Wikipedia-page which lists contemporary artists.
[12] This analysis only takes into account the art objects for which the Art Sales Index indicates the year of creation. In total, the necessary information is available for about 45% of the observations in our dataset.
[13] It mainly concerns art from the second half of the nineteenth century.

Russian avant-garde; (iii) art created in the period 1936-1953, which are the last years under Stalin; (iv) art created in the period 1954-1985, which is the post-Stalin, pre-Gorbachev cold war time frame. The returns are calculated over the whole four decades considered in this study, and over three shorter, recent time intervals: (i) 1985-1991, which are the turbulent last years of the USSR, when Gorbachev tried to reform; (ii) 1991-1999, the first chaotic post-Soviet years during which Boris Yeltsin was president of the Russian federation; (iii) 1999-2007, the Putin years, in which Russia's economy (and Russian nationalism) grew impressively. The results are shown in Table 6.

[Insert Table 6 about here]

One of the most interesting conclusions from Table 6 is that nineteenth century art, which is thus art from the great Russian Empire, did remarkably poorly in the years when the USSR was dissolving (1985-1991). In the same period, art from the later Stalin years appreciated fast. After 1991, however, Russian art from before 1900 started to outperform the other categories. Between 1999 and 2007, it even recorded an annualized real return of 22.89%. In general, it seems that a clear taste for older art has developed in recent years.[14]

6. Art and financial assets

This section compares the returns on art to the returns on a number of financial assets. With respect to financial data, we collect data from Global Financial Data on indices measuring total real returns on the GFD global index for government bonds, the GFD world index for equity, and the S&P 500. Since the mid-1990s, we also have return data for the dollar-denominated Russian stock market index RTS, which were downloaded from the website http://www.rts.ru.[15] For art, we report both the real returns on the global art index and on the Russian art index presented in this study. Table 7 compares the returns since 1967 and 1997 in Panels A and B, respectively.

[Insert Table 7 about here]

[14] This finding seems to confirm what an editor of The Art Newspaper wrote a few years ago: "The new wealthy tend to collect the art of their own countries. They buy conservatively; traditional things" (The Independent 2006).
[15] The nominal returns were converted to real returns using US CPI (since the index is dollar-denominated).

Over the longer time frame, art clearly shows to be an inferior financial investment (see Panel A). Although the annualized returns on the global art and Russian art indices are comparable to those on the global index for government bonds, the volatility of both art indices is clearly higher.[16] However, over shorter time frames, art can do very well. For example, since 1997 (Panel B), art has significantly outperformed the world bond and stock indices considered here. This is thanks to a boom in the art market in the years leading up to 2007. As reported before, the Russian art index has done even better than our global art index, while the returns on Russian stocks were also higher than those on the other stock indices. We also calculate the Sharpe ratio, which is the return corrected for the risk-free rate and divided by the volatility of the asset, for each asset in Table 7. When we consider the total time frame 1967-2007, the Sharpe ratio of Russian art indicates that an investment in this type of art is not competitive relative to investments in bonds or stocks. However, over the last deade, the Sharpe ratio points out that Russian art has been an very good investment, even considering its risk.

To shed more light on the relationship between financial assets and art indices, Panel A of Table 8 shows the correlations between the different asset categories since 1997. There are large positive correlation coefficients between the returns on stocks on the one hand and those on art on the other. The global art index shows the largest positive correlation with the global stock index and with US stocks, while the Russian art index is correlated mainly with the global index and with Russian stocks. We also performed simple Granger causality tests (with a lag of one year) to check whether it are really changes in stock prices that cause art price trends. Panel B of Table 8 reports the chi-square statistics of these tests. We can statistically reject the null hypotheses that stock markets do not Granger-cause art indices.[17] The results are particularly strong for the Russian art index, which indeed seems impacted by global and (especially) Russian stock market movements.

[Insert Table 8 about here]

[16] Also note that the standard deviation of the art index still underestimates the true riskiness of art investments, as explained in Renneboog and Spaenjers (2009).

[17] Not-reported tests show that we cannot reject the opposite null hypotheses, i.e. that our art indices do not Granger-cause the stock market indices.

7. Conclusion

This study has looked into the price formation and returns in one of the most prominent emerging art markets, i.e. Russia. Sales of art from emerging markets such as Russia have boomed following the impressive economic performance (and strong growth in the number of wealthy individuals) in these countries over the last decade. We employ a hedonic regression model, in line with Renneboog and Spaenjers (2009), to determine the annual returns. However, the results also allow us to say something about the price formation in the Russian art market. For example, we find that Russian objects of art are sold at a discount when the signature or date are lacking. In contrast, it seems that premiums are paid for art works without any doubt about the attribution, for abstract art, for oil paintings (relative to prints and works on paper), and for works auctioned by Sotheby's New York or London, or by Christie's London. The most valuable art auctions are held in May and June in the first semester, and in November and December in the second one.

The annual real return for Russian art amounts to 4.07% (in real USD terms) over the period 1967 to 2007. Although Russian art has followed a trend similar to that of the global art market, it has significantly outperformed the art market as a whole in the 2000s, even when we correct for differences in riskiness. We observe that especially art from the nineteenth century has done well since the collapse of the USSR. The finding that the wealth creation in Russia in recent years has been followed by a surge in prices for Russian art clearly hints at the existence of both a home bias and a wealth creation effect in the art market.

Appendix 1: Titles and topics

This appendix lists the search strings used on the first word(s) of the title of a work to create the topic dummies used in this study. Although most titles in our database are in English, we also account for French titles by including French keywords in the analysis. We avoid search strings that can be used in different contexts. If a relevant word (e.g. “chat”) can also be part of a word that does not belong in the topic category (e.g. “chateau”), then we only search for titles that are not longer than the word itself or in which the relevant word is followed by a space (e.g. “chat_”). These are the topic categories, along with their search strings:

1. ABSTRACT: “abstract”, “composition”
2. ANIMALS: “horse”, “cheval”, “chevaux”, “cow_”, “cows”, “vache”, “cattle”, “cat_”, “cats”, “chat_ “, “dog_”, “dogs”, “chien”, “sheep”, “mouton”, “bird”, “oiseau”
3. LANDSCAPE: “landscape”, “country landscape”, “coastal landscape”, “paysage”, “seascape”, “sea_”, “mer_”, “mountain”, “river”, “riviere”, “lake”, “lac_”, “valley”, “vallee”
4. NUDE: “nude”, “nu_”, “nue_”
5. PEOPLE: “people”, “personnage”, “family”, “famille”, “boy”, “garcon”, “girl”, “fille”, “man_”, “men_”, “homme”, “woman”, “women”, “femme”, “child”, “enfant”, “couple”, “mother”, “mere_”, “father”, “pere_”, “lady”, “dame”
6. PORTRAIT: “portrait”
7. RELIGION: “jesus”, “christ_”, “apostle”, “ange_”, “angel”, “saint_”, “madonna”, “holy_”, “mary magdalene”, “annunciation”, “annonciation”, “adoration”, “adam and eve”, “adam et eve”, “crucifixion”, “last supper”
8. SELF-PORTRAIT: “self-portrait”, “self portrait”, “auto-portrait”, “autoportrait”
9. STILL_LIFE: “still life”, “nature morte”, “bouquet”
10. UNTITLED: “untitled”, “sans titre”
11. URBAN: “city”, “ville”, “town”, “village”, “street”, “rue”, “market”, “marche”, “harbour”, “port_”, “paris”, “london”, “londres”, “new york”, “amsterdam”, “rome_”, “venice”, “venise”

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Table 1: Number of observations per year and most frequently sold artists

Panel A of Table 1 displays the number of observations in our dataset for each year from 1954 until 2007. Panel B shows the ten artists with the largest numbers of sales in our dataset. The construction of the dataset is described in detail in Section 2 of this paper.

Panel A: Number of observations per year

Year	N	Year	N
1954	3	1981	931
1955	1	1982	802
1956	2	1983	919
1957	12	1984	785
1958	3	1985	989
1959	10	1986	888
1960	10	1987	1,338
1961	45	1988	1,604
1962	23	1989	1,927
1963	11	1990	1,551
1964	8	1991	1,029
1965	22	1992	931
1966	45	1993	1,048
1967	68	1994	1,221
1968	131	1995	1,312
1969	42	1996	1,567
1970	155	1997	1,595
1971	222	1998	1,776
1972	328	1999	1,847
1973	361	2000	1,665
1974	541	2001	1,653
1975	455	2002	1,824
1976	673	2003	1,979
1977	643	2004	3,241
1978	625	2005	4,563
1979	866	2006	4,355
1980	1,031	2007	2,478

Panel B: Artists with the largest number of sales

Artist	N
Marc Chagall	6,973
Andre Laskoy	2,650
Serge Poliakoff	1,797
Mane-Katz	1,698
Leopold Survage	1,422
Mstislav Dobuzhinksy	1,169
Serge Charchoune	1,151
Erte (Roman de Tirtoff)	1,104
Alexei Jawlensky	1,056
Natalia Goncharova	991

Table 2: Descriptive statistics hedonic variables

Table 2 displays the descriptive statistics for the hedonic variables used in this study. DECEASED is a dummy variable that equals one if the artist has died prior to the sale. The attribution dummies ATTRIBUTED, STUDIO, CIRCLE, SCHOOL, AFTER, and STYLE equal one if the auction catalogue identifies the work as being "attributed to" the artist, from the "studio" of that artist, from the "circle" of the artist, from the artist's "school", "after" the artist, or "in the style of" the artist, resp. The authenticity dummies SIGNED, DATED, and INSCRIBED take the value one if the work carries a signature of the artist, is dated, or has an inscription, resp. The medium dummies OIL, PRINT, and PAPER indicate whether the work is an oil painting, a print, or a work on paper. The variables HEIGHT and WIDTH measure the height and the width of the work in inches. The topic dummies are based on the first word(s) of the title of the work: see Appendix 1. The auction house dummies SOTH_LONDON, SOTH_NY, SOTH_OTHER, CHR_LONDON, CHR_NY, and CHR_OTHER equal one if the sale takes place at Sotheby's London, Sotheby's New York, another branch of Sotheby's, Christie's London, Christie's New York, or another Christie's office, resp. The month dummies indicate the month of the sale. For each variable, we report the number of observations (N). For dummy variables we also report the number of zeros and ones, while we show the mean value and the standard deviation (S.D.) for HEIGHT and WIDTH.

	N	0	1	Mean	S.D.
DECEASED	52,154	4,335	47,819		
Attribution dummies					
ATTRIBUTED	52,154	51,701	453		
STUDIO	52,154	52,045	109		
CIRCLE	52,154	52,121	33		
SCHOOL	52,154	52,144	10		
AFTER	52,154	51,936	218		
STYLE	52,154	52,094	60		
Authenticity dummies					
SIGNED	52,154	9,420	42,734		
DATED	52,154	34,717	17,437		
INSCRIBED	52,154	44,517	7,637		
Medium dummies					
OIL	52,154	25,353	26,801		
PRINT	52,154	47,415	4,739		
PAPER	52,154	31,540	20,614		
Size variables					
HEIGHT	51,520	N.A.	N.A.	19.78	11.34
WIDTH	51,515	N.A.	N.A.	19.61	12.36
Topic dummies					
STUDY	52,154	51,728	426		
ABSTRACT	52,154	47,332	4,822		
ANIMALS	52,154	51,908	246		
LANDSCAPE	52,154	50,403	1,751		
NUDE	52,154	51,691	463		
PEOPLE	52,154	49,840	2,314		
PORTRAIT	52,154	50,312	1,842		
RELIGION	52,154	51,978	176		
SELF-PORTRAIT	52,154	51,986	168		
STILL_LIFE	52,154	50,112	2,042		
UNTITLED	52,154	51,383	771		
URBAN	52,154	51,166	988		
Auction house dummies					
SOTH_LONDON	52,154	44,542	7,612		
SOTH_NY	52,154	47,595	4,559		
SOTH_OTHER	52,154	50,582	1,572		
CHR_LONDON	52,154	49,059	3,095		
CHR_NY	52,154	49,422	2,732		
CHR_OTHER	52,154	50,707	1,447		
Month dummies					
JANUARY	52,154	51,159	995		
FEBRUARY	52,154	49,345	2,809		
MARCH	52,154	47,308	4,846		
APRIL	52,154	47,211	4,943		
MAY	52,154	45,463	6,691		
JUNE	52,154	43,566	8,588		
JULY	52,154	50,422	1,732		
AUGUST	52,154	51,921	233		
SEPTEMBER	52,154	50,864	1,290		
OCTOBER	52,154	47,311	4,843		
NOVEMBER	52,154	43,657	8,497		
DECEMBER	52,154	45,467	6,687		

Table 3: Estimation results of the hedonic regression

Table 3 presents the hedonic regression results. Our model, presented in equation (1), is estimated using OLS. The dependent variable is the natural log of the price in year 2007 USD. The price impact is calculated by taking the exponent of the coefficient, and subtracting one. For the definitions of the independent variables: see Table 2.

	Coefficient	S.D.	T-statistic	Impact
Year dummies	[incl.]			
Artist dummies	[incl.]			
DECEASED	-0.205	0.022	-9.26	-18.50%
Attribution dummies				
ATTRIBUTED	-0.747	0.043	-17.25	-52.60%
STUDIO	-0.449	0.089	-5.02	-36.17%
CIRCLE	-1.205	0.155	-7.77	-70.02%
SCHOOL	-1.263	0.280	-4.51	-71.71%
AFTER	-0.241	0.061	-3.94	-21.44%
STYLE	-1.415	0.117	-12.05	-75.70%
Authenticity dummies				
SIGNED	0.200	0.012	16.66	22.09%
DATED	0.092	0.010	9.12	9.62%
INSCRIBED	-0.074	0.012	-6.13	-7.12%
Medium dummies				
OIL	[left out]			
PRINT	-2.836	0.021	-134.08	-94.14%
PAPER	-0.833	0.012	-71.83	-56.51%
Size variables				
HEIGHT	0.036	0.001	44.61	3.66%
HEIGHT^2	-1.3E-04	0.000	-23.47	-0.01%
WIDTH	0.026	0.001	32.28	2.64%
WIDTH^2	-1.1E-04	0.000	-20.28	-0.01%
Topic dummies				
STUDY	-0.233	0.044	-5.25	-20.78%
ABSTRACT	0.071	0.019	3.70	7.35%
ANIMALS	-0.152	0.057	-2.66	-14.13%
LANDSCAPE	-0.132	0.023	-5.83	-12.33%
NUDE	-0.171	0.043	-3.98	-15.69%
PEOPLE	-0.124	0.020	-6.33	-11.64%
PORTRAIT	-0.196	0.023	-8.65	-17.84%
RELIGION	-0.178	0.068	-2.63	-16.31%
SELF-PORTRAIT	-0.064	0.070	-0.92	-6.23%
STILL_LIFE	-0.063	0.021	-2.94	-6.08%
UNTITLED	-0.218	0.034	-6.38	-19.61%
URBAN	-0.001	0.029	-0.02	-0.06%
Auction house dummies				
SOTH_LONDON	0.588	0.013	45.21	80.07%
SOTH_NY	0.555	0.016	35.83	74.25%
SOTH_OTHER	0.394	0.024	16.30	48.28%
CHR_LONDON	0.598	0.018	33.62	81.92%
CHR_NY	0.396	0.019	20.74	48.54%
CHR_OTHER	0.064	0.024	2.64	6.65%
Month dummies				
JANUARY	-0.336	0.031	-11.03	-28.56%
FEBRUARY	-0.259	0.020	-13.04	-22.84%
MARCH	-0.171	0.016	-10.49	-15.69%
APRIL	-0.050	0.017	-3.01	-4.85%
MAY	0.031	0.015	2.05	3.14%
JUNE	[left out]			
JULY	-0.285	0.024	-11.65	-24.80%
AUGUST	-0.342	0.059	-5.76	-28.96%
SEPTEMBER	-0.308	0.027	-11.36	-26.53%
OCTOBER	-0.163	0.016	-9.91	-15.06%
NOVEMBER	0.077	0.014	5.46	8.02%
DECEMBER	-0.023	0.015	-1.51	-2.24%
Number of observations	51,514			
Adjusted R-square	0.6987			
F-value	237.12			

Table 4: Index values and returns

Panel A of Table 4 presents the Russian art index. The index values are calculated by taxing the exponent of the coefficients on the year dummies in the model presented in equation (1) and estimated in Table 3. The returns are calculated by dividing the index value by the index value in the previous year, and are in real terms. The index value for 1967 is set equal to 100. Panel B shows the annualized real returns based on the Russian art index per decade since 1967, and over the whole 1967-2007 time frame. It also includes the geometric average returns on the global art index constructed in benchmark model (3) in Renneboog and Spaenjers (2009) for the same time periods.

Panel A: Index values of Russian art index

Year	Index	Return	Year	Index	Return
1967	100.00		1988	259.99	20.49%
1968	119.38	19.38%	1989	327.82	26.09%
1969	65.99	-44.72%	1990	397.27	21.19%
1970	88.66	34.34%	1991	225.13	-43.33%
1971	126.43	42.60%	1992	195.48	-13.17%
1972	143.07	13.16%	1993	171.74	-12.14%
1973	234.24	63.73%	1994	176.51	2.77%
1974	215.27	-8.10%	1995	169.65	-3.89%
1975	172.46	-19.89%	1996	174.56	2.89%
1976	129.88	-24.69%	1997	153.32	-12.17%
1977	109.20	-15.92%	1998	166.32	8.48%
1978	123.49	13.09%	1999	164.77	-0.93%
1979	129.57	4.93%	2000	165.08	0.19%
1980	123.45	-4.72%	2001	167.41	1.41%
1981	122.40	-0.85%	2002	199.93	19.43%
1982	102.50	-16.26%	2003	234.48	17.28%
1983	98.28	-4.11%	2004	317.59	35.44%
1984	94.90	-3.45%	2005	330.84	4.17%
1985	113.67	19.79%	2006	391.82	18.43%
1986	139.70	22.90%	2007	493.52	25.96%
1987	215.77	54.45%			

Panel B: Returns on Russian art index and global art index

Sample	N	1967-1977	1977-1987	1987-1997	1997-2007	1967-2007
Russian art index (baseline results)	51,514	0.88%	7.05%	-3.36%	12.40%	4.07%
Global art index (Renneboog and Spaenjers 2009)	1,152,173	2.38%	6.08%	-1.74%	6.08%	3.15%

Table 5: Sample selection and survivorship issues

Table 5 compares the geometric mean real returns on our Russian art index for different time frames to the returns that follow from a hedonic regression model using different subsamples of artists, to check the robustness of our results. Section 4 of this paper describes the construction of the different subsamples.

Sample	N	1967-1977	1977-1987	1987-1997	1997-2007	1967-2007
All Russian artists (baseline results)	*51,514*	*0.88%*	*7.05%*	*-3.36%*	*12.40%*	*4.07%*
Artists in Renneboog and Spaenjers (2009)	35,170	0.48%	7.46%	-3.38%	12.29%	4.03%
Artists with sales 1954-1989	45,462	0.94%	7.12%	-3.47%	11.96%	3.97%
Observations with artist deceased at time of sale	47,225	1.32%	6.42%	-2.90%	12.18%	4.10%

Table 6: Changing tastes

Table 6 compares the geometric mean real returns on our Russian art index for different time frames to the returns that follow from a hedonic regression model using different subsets of art, based on the creation date of the work. Section 5 of this paper describes the construction of the different subsets.

Sample	N	1967-2007	1985-1991	1991-1999	1999-2007
All Russian art (baseline results)	51,514	4.07%	12.06%	-3.83%	14.70%
Art from 1800-1899	1,913	10.95%	5.17%	9.63%	22.89%
Art from 1900-1935	9,057	5.98%	13.68%	-2.59%	17.32%
Art from 1936-1953	4,257	2.32%	18.34%	-6.97%	14.36%
Art from 1954-1985	7,984	3.53%	9.85%	-4.65%	8.70%

Table 7: Comparison with financial assets

Table 7 compares the geometric mean real return and volatility of a global art index and our Russian art index with the return and volatility of some financial indices since 1967 (in Panel A) and since 1997 (in Panel B). The total real return data of the global indices for government bonds and stocks, and the index for US stocks, come from Global Financial Data. Russian stock market data were downloaded from the website of the Russian stock exchange, and subsequently deflated to get real returns. The data for the global art index come from Renneboog and Spaenjers (2009). The table also includes ex-post Sharpe ratios, using the T-bill index, also from Global Financial Data, as a measure of the risk-free return.

Panel A: 1967-2007

	World bonds	World stocks	US stocks	Russian stocks	All art	Russian art
Mean real return	0.0323	0.0572	0.0763	N.A.	0.0315	0.0407
Volatility	0.0997	0.1720	0.1769	N.A.	0.1478	0.2295
Sharpe	0.1914	0.2557	0.3586	N.A.	0.1192	0.1166

Panel B: 1997-2007

	World bonds	World stocks	US stocks	Russian stocks	All art	Russian art
Mean real return	0.0299	0.0471	0.0713	0.1063	0.0608	0.1240
Volatility	0.0552	0.1504	0.1581	0.4400	0.0824	0.1225
Sharpe	0.3624	0.2470	0.3905	0.2002	0.6151	0.9246

Table 8: Correlations and causality

Panel A of Table 8 shows the correlation matrix of the yearly real returns on the categories introduced in Table 7 between 1997 and 2007. Panel B reports the chi-square statistics associated with a null hypothesis that the asset class in the first column does not Granger cause the global art index or the Russian art index. *, **, and *** indicate significance on the 10%, 5%, and 1% level, respectively.

Panel A: Correlations

	World bonds	World stocks	US stocks	Russian stocks	All art	Russian art
World bonds	1.0000					
World stocks	-0.3868	1.0000				
US stocks	-0.3289	0.9227	1.0000			
Russian stocks	-0.0685	-0.3001	-0.5970	1.0000		
All art	0.1209	0.5212	0.3679	0.1942	1.0000	
Russian art	0.1223	0.3041	0.1140	0.2955	0.7697	1.0000

Panel B: Granger causality

	All art	Russian art
World bonds	0.07	0.98
World stocks	2.76*	4.57**
US stocks	3.22*	5.87**
Russian stocks	4.41**	6.99***
All art	-	0.50
Russian art	0.14	-

Figure 1: Russian art index and global art index

Figure 1 compares the values on the Russian art index constructed in this paper (see Table 4) to the values on the global art index of Renneboog and Spaenjers (2009). For both indices, the value in 1967 is set equal to 100.