Emerging Art Markets

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Abstract

This paper analyzes the performance and risk-return characteristics of three major emerging art markets: Russia, China, and India. According to three national art market indices, built by hedonic regressions based on auction sales prices, the geometric annual returns are 10.00%, 5.70%, and 42.20% for Russia (1985–2008), China (1990–2008), and India (2002–2008), respectively. The Russian art market exhibits positive correlations with most common financial assets and a positive market beta, whereas the Chinese art market demonstrates a negative correlation overall and a negative market beta, and the Indian art index reveals a negative market beta and varying correlation results. Portfolio optimization under a power utility framework suggests limited diversification potential, but with a downside beta of 0.43, investing in Chinese art offers hedging potential during financial market downswings. Investigating the linkages between art and the economy through co-integration and causality analyses proves that emerging art markets share a significant long-term relation with other financial market instruments, but the short-term relations are largely absent.

Keywords: Art market index, Art investments, Art finance, Alternative assets, Portfolio allocation
JEL Classification Codes: G11, G14

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I. Introduction

Many investors in grim economic days search for alternative investment opportunities to shield themselves from declining stock markets. Not surprisingly, many of those investors turn to the art market—a seemingly isolated market, yet contrarily a market for luxury goods, bought when welfare is abundant and economic circumstances are positive. These two aspects make the art market an interesting subject for investment research. In particular, emerging markets in Russia, China, and India provide appealing circumstances that may help answer questions about whether investing in art can function as a shield in an economic downturn.

The growth in these emerging economies, which apparently has affected their national art markets, has not gone unnoticed by market commentators. Recent reports by Artprice note the booming art market for Russia, 780% growth for Chinese (contemporary) art since 2001, and 830% growth for the Indian (contemporary) art market during the past decade.[1] A consequence of their economic boom seems to be that their national art markets have grown into lucrative businesses for not only the artists themselves but also potential investors. Investing in art does not necessarily provide a good alternative for diversification purposes though; Artprice also reports that the global art market declined by 7.5% in the first quarter of 2008 and attributes this plunge to the deteriorating worldwide economic situation.

Although research into art finance remains fairly minimal, a growing body of academic papers has appeared in recent years. These studies generally take an investment perspective and focus on the returns that art generates, as well as whether art provides an attractive alternative in a well-diversified portfolio of common stocks and bonds. Estimates of the returns on art take three different approaches: naïve art price indices (Candela and Scorcu 1997), the repeat sales method (Anderson 1974; Baumol 1986; Mei and Moses 2002; Pesando 1993), and hedonic regressions (Buelens and Ginsburgh 1993; Renneboog and van Houtte 2002). Chanel, Gérard-Varet, and Ginsburg (1996) apply both the repeat sales and hedonic regression methods and conclude that the use of hedonic regressions leads to more precise estimates of returns that allow for the use of all observed transactions instead of solely artwork sold at least twice. We apply an advanced hedonic regression analysis, based on the recently developed two-step methodology proposed by Kraeussl and van Elsland (2008).

The large degree of diversity in the data sets used and countries analyzed provokes similarly great diversity in the returns noted by previous research. Nominal average annual returns range from 0.6% to 52.9%. These varied data sets make it difficult to compare the empirical findings, yet it would be reassuring if researchers found comparable results when referring to matters such as correlation. However, though the figures consistently are positive, the degree of correlation of art indices with

[1] These art market reports, entitled *Art Market Insight*, are downloadable for free from the Web site www.artprice.com. We refer to the following reports: "Contemporary Russia—An Emerging Market," published in May 2007; "China Edges Out France as the 3rd Largest Art Auction Market," published in February 2008; and "Contemporary Indian Art—An Explosive Market," published in April 2008.

stocks varies substantially, from 0.16 for Worthington and Higgs (2004) to 0.19 for Kraeussl and van Esland (2008) to 0.44 for Hodgson and Vorvink (2003). The same holds for market beta, which varies from 0.25 in Kraeussl and van Esland (2008) to 0.36 in Hodgson and Vorvink (2003) to 0.82 in Stein (1977).

Using data provided by Art Market Research pertaining to European and American paintings, Worthington and Higgs (2004) find no diversification benefits when they include art in an optimized portfolio. By the same means, Renneboog and van Houtte (2002) and Kraeussl and van Esland (2008) find limited potential for Belgian and German art, respectively. An "ordinary" portfolio that features stocks and bonds seems to dominate any portfolio that also includes art, with a few exceptions such as a certain range of standard deviation (Renneboog and van Houtte 2002) or a maximum weight constraint for certain asset classes (Kraeussl and van Esland 2008).

Adopting a different angle, Goetzmann (1993) uses vector autoregressive models to examine causal relations between the art market and the London Stock Exchange (LSE). He finds that the LSE influences the art market and concludes that wealth determines the price; that is, a rise in the stock market appears to relax the wealth constraint, which then increases prices for art. Chanel (1995) tests for causality among different national stock markets and art prices and finds that stock markets represent significant exogenous variables that cause changes in the value of art. Ginsburgh and Jeanfills (1995) perform a co-integration analysis for the U.S., English, and French art markets and their respective national stock markets, in which they find short-term causality but no significant long-term relationships. Worthington and Higgs (2003) use similar techniques to study the long- and short-term dependencies among eight different schools of painters and the MSCI World Equity Index. According to their variance decomposition analysis, art markets are highly endogenous. Finally, in a more recent study, Kraeussl and Roelofs (2008) use both semi-annual and quarterly data to investigate the linkages between art markets and the economy during the past 50 years; they find weak co-integration results but also some significant causal relations between the global art market and the economy.

This study attempts to contribute to art finance literature in several ways. In particular, it is the first to analyze the performance of *emerging* art markets. With data collected from *Artnet.com*, we estimate hedonic regressions and construct three art price indices for Russia (1985–2008), China (1990–2008), and India (2002–2008). We investigate their risk and return characteristics, as well as their potential diversification benefits in an optimal portfolio. That is, we do not consider only art investments or stock and bond markets but also include more alternative asset classes, such as hedge funds, private equity, and real estate. We also examine the downside risk of art investments and their hedging potential during financial downswings. Our contribution to existing literature on the linkages between the art market and the economy also features a comprehensive analysis of the possible exogenous determinants of art prices, such as stock, commodities, and real estate markets, as well as aggregate wealth levels, inflation, and interest rates. We test for long-term linkages between pairs of

variables, using Johansen's (1991) co-integration tests, then employ Granger's (1969) causality tests to examine the short-term relations between the art market and the economic environment.

Our results show that Russian art earns a positive market beta and a positive correlation with most assets and beats the S&P 500 by 0.77% annually. The return analysis further shows that Chinese art has a negative market beta and negative correlation with many common asset classes, but the annual returns are rather small, with 5.70% geometrically. The Indian art market has the strongest geometric return of 42.26%, a nearly zero correlation with the S&P 500, and a negative market beta of -0.27. Furthermore, the results of our optimal asset allocation analysis with a power utility framework indicate that art has a limited role in terms of diversification. For a risk-aversion parameter of 2 and a 15% weight constraint, 6% of the overall investment portfolio would be allocated to Chinese art, with nothing invested in Russian art. Downside risk, measured according to the downside beta, is close to 0 for Russian art and 0.43 for the Chinese art index, which suggests the potential of Chinese art as a hedge during financial market downswings. By using a vector autoregressive (VAR) model to analyze potential linkages between art markets and the economic environment, we find strong co-integration results that indicate a long-term relation of art to other financial markets. However, our Granger (1969) causality test results are weak, implying that the short-term relations between art markets and the economy are largely absent. On the basis of these empirical findings, we conclude that the emerging art markets of Russia, China, and India provide interesting investment opportunities for the purpose of optimal portfolio allocation.

The remainder of this article proceeds as follows: In Section II, we describe the sample, variables, and methodology for estimating the hedonic regressions. Section III contains the hedonic regression results, as well as the resulting indices for the Russian, Chinese, and Indian art markets. We next discuss the risk and return characteristics of the three art market indices and the empirical findings of the optimal asset allocation analysis and downside risk computations. Finally, we present the co-integration and causality analyses that we use to investigate the potential linkages between art markets and the economy and then conclude in Section IV.

II. Data and Methodology

All data regarding art prices come from *Artnet.com*, a large online auction sales database. Our sample consists of 24,524 paintings from the Russian art market during the period 1985 to 2008; 7,172 from the Chinese art market during 1990 to 2008; and 2,858 from the Indian art market during 2002 to 2008. Data for other asset classes come from the *Thomson Financial DataStream*, except for the ten-year Treasury bonds and three-month T-bill rate, which we retrieve from the *St. Louis Fed*. We employ the following asset classes for our empirical analysis: the RTS index represents the national stock market for Russia; the SSE composite refers to the national stock market for China; the BBE 100 represents the national stock market for India; the S&P 500 is the American stock market; ten-year Treasury bonds reflect the government bond market; the three-month T-bill rate is the government

short-term bond market; the Merrill Lynch Corporate Bonds Master index represents the corporate bond market; the CBR Spot index indicates the commodity market; the CS/Tremont Hedge Fund index represents the hedge fund market; the LPX 50 is the private equity market; and the World-DataStream REITS represents the real estate market. To obtain economic indicators such as national gross domestic product (GDP) and consumer price index (CPI) rates, we rely on the *Main Economic Indicators* database of the OECD.

In addition to time-dummy variables the hedonic regression method requires us to specify quality characteristic variables, to build the art market index. The auction sales price, as the dependent variable, must be transformed into its natural logarithm, so that the hedonic regression may be denoted by the following equation:

$$\ln(P_{kt}) = \alpha_0 + \sum_{j=1}^{x} \beta_j X_{nkt} + \sum_{t=1}^{t} \lambda_t C_t + \varepsilon_{kt} \qquad \text{with} \qquad \varepsilon \sim N\left(0, \sum_k \Theta I_t\right), \qquad (1)$$

where $P_{kt} = f(x_{1,kt}, x_{2,kt},\ldots,x_{x,kt})$ is a vector of the sales prices, α_0 represents the regression intercept, β_j is the coefficient value for the quality characteristic x, X_{nkt} is the quality characteristic value of a particular painting n, λ_t indicates the coefficient value for the time dummy t, C_t reflects the time period value that may be equal to 1 or 0, and ε_{kt} is the disturbance term. To create the corresponding art market index, we take the antilog of the sequence of time dummies λ_t.

Because paintings are heterogeneous assets, we use hedonic modeling to correct for the characteristics that make artworks unique. We denote these hedonic variables as physical characteristics, such as auction houses, media and materials, and surfaces, and non-physical characteristics, such as estimate price, artist's signature, and artist's reputation.

Auction house. Previous research shows that artists who are more reputable tend to sell their works at more prestigious auction houses, such as Christie's and Sotheby's. Because we investigate three different emerging art markets, the relevant auction houses differ, and we employ a *market importance* criterion, defined as the auction house's share of a particular national market. Christie's and Sotheby's (in both London and New York) have large shares of Russian art and therefore provide the correcting variables. The coefficients for these major auction houses should be positive and higher than those for the less relevant auction houses, namely, Artus, Gridel & Boscher, Christie's South Kensington, Gros & Delettrez, Millon & Robert, and Rabourbin & Choppin de Janvry. In the same way, we select the relevant auction houses for China: Christie's Hong Kong, Christie's New York, Poly International Auction, Ravenel, Sotheby's Hong Kong, and Sotheby's New York. Those for the Indian art market are Bonhams London, Christie's Hong Kong, Christie's New York, Saffronart, Sotheby's London, and Sotheby's New York. The auction house variables are specified as dummies, such that 1 indicates the specific painting has sold through a particular auction house. In all cases, "other auction house" provides the reference variable, which does not appear in the hedonic regression.

Media and material. According to previous research, oil on canvas is the combination of medium and material that claims the highest average prices; therefore, we use it as the reference variable. However, different media may be subject to differences across countries. Hence for the Russian art market, we consider the following medium and material combinations: acrylic on canvas, mixed media, oil on board, oil on cardboard, oil on panel, oil on paper, tempera on paper, and other. The combinations for China are acrylic on canvas, ink and color, mixed media, oil on board, oil on paper, and other; those for the Indian art market are acrylic on canvas, mixed media, oil on board, and other. The variables again are specified as dummy variables, such that 1 indicates that a painting has a certain combination of medium and material, and "other" stands for all other materials, excluding those specified as regression variables and the reference variable, oil on canvas.

Surface. This size variable denotes a painting's dimension of height by width. The surface of a painting should have a positive influence on its sales price. In line with the transformation of sales prices, we log the surface values.

Estimate price. A dummy "no estimate" variable indicates whether the auction house offers an estimate price for a certain painting. The availability of this information should have a positive influence on the sales price (Ashenfelter and Graddy 2003). We specify this variable as a dummy, such that 1 indicates a missing estimate price.

Signature. A painting unsigned by the artist or that lacks other marks of authenticity likely earns a lower sales price. A buyer would be more prepared to pay a relatively higher price for a particular painting if he or she were more confident of its authenticity. Again, we specify this variable as a dummy, for which 1 indicates the lack of any sign of authenticity.

Reputation. Finally, this variable provides a means to separate a more highly from a less highly rated artist in a relative sense. In most previous studies, researchers account for the artist's reputation by adding dummy variables. For example, if 100 artists appeared in the sample, the researcher must specify 99 dummies. More than 1,000 artists appear in our sample, so we adopt a less cumbersome approach that guarantees an interpretable model. In accordance with Kraeussl and van Esland's (2008) two-step hedonic methodology, we first estimate the standard hedonic regression from Equation (1), without the reputation variable or any artist dummies. In the second step, we manually compute:

$$Index_y = \frac{\prod_{i=1}^{n}(P_{i,y})^{1/n}}{\exp\left[\sum_{j=1}^{x}\beta_j\left(\sum_{i=1}^{n}\frac{X_{ij,y}}{n}-\sum_{i=1}^{m}\frac{X_{ij,r}}{m}\right)\right]} \Bigg/ \frac{\prod_{i=1}^{m}(P_{i,r})^{1/m}}{\exp\left[\sum_{j=1}^{x}\beta_j\left(\sum_{i=1}^{n}\frac{X_{ij,y}}{n}-\sum_{i=1}^{m}\frac{X_{ij,r}}{m}\right)\right]}, \qquad (2)$$

where P_y is the sales price of a particular artist y, P_r indicates the sales price of the reference artist r, n is the number of paintings by a particular artist y, m is the number of paintings by the reference artist r, β_j refers to the regression coefficient of a particular quality characteristic j, $X_{ij,y}$ is the particular

painting's quality characteristic value for the artist *y*, and $X_{ij,r}$ indicates the particular painting's quality characteristic value for the reference artist *r*.

We multiply the resulting two-step hedonic index by 100, such that the index value equals 100 for the reference artist. Index values less than 100 indicate relatively lower valued artists, whereas an index value of greater than 100 would designate a relatively higher valued artist. We select the artist with the highest multiple value of average sales prices and total number of sales as the reference artist. As a result, the following reference artists occur for the three emerging art markets: Marc Chagall (originally from Belarus), Zao Wou-Ki (a contemporary artist from China), and Francis Newton Souza (a contemporary artist from India). In a final step, we transform the resulting art market indices into natural logarithms.

III. Discussion of Results

A. Emerging Art Market Indices

This section presents the hedonic regression results for the Russian, Chinese, and Indian art markets and their corresponding art indices. Panel A of Table I shows the results of the hedonic regression results for the Russian art market. The model is based on 24,524 paintings during the period 1985–2008 and explains more than 84% of the price variability in the Russian art market. All *auction house* variables are highly significant at the 1% level. The coefficient signs are also as expected; the major auction houses Christie's and Sotheby's earn the highest prices on average. In line with previous research, Sotheby's New York achieves higher prices than Sotheby's London, and all auction houses other than Christie's South Kensington earn higher prices than the reference variable. Contrarily, the hedonic regression results for *common media, materials, and combinations* are inconsistent with previous findings. Three dummy variables appear insignificant for the Russian market: mixed media, tempera on paper, and other. Of the remaining variables, only acrylic on canvas has the expected sign. Surprisingly, oil on board, cardboard, panel, and paper all demand higher prices on average than oil on canvas. The *surface* variable, consistent with our expectations, has a positive coefficient and a reasonably sized factor loading of 0.30. The *no estimate* variable, though highly significant, carries a positive sign, in contrast with our expectations. The *unsigned* dummy indicates a negative coefficient, in accordance with our expectations, but the variable is insignificant, and the factor loading is very small. Finally, the results in Panel A demonstrate that with a factor loading of 7.17, the most relevant hedonic variable for the Russian art market is, as expected, an artist's *reputation*.

< INSERT TABLE I ABOUT HERE >

Panel B of Table I refers to the hedonic regression for the Chinese art market, which uses 7,172 observations from 1990–2008 and explains approximately 70% of the price variability in the Chinese art market. Results for the *auction house* dummies show that the importance of certain auction houses strongly varies across national art markets. Even though Christie's New York commands a relatively higher price, the same effect does not hold for Sotheby's New York. Both Christie's and Sotheby's

Hong Kong have high significance and a considerable factor loading, which makes them the two most highly rated auction houses for Chinese art. The regression results also prove that, as expected, oil on canvas commands the highest prices for Chinese art, relative to nearly all other *common media, materials, and combination* dummy variables. The *surface* variable returns a positive coefficient of 0.27, in support of the importance of the size of a painting in determining its price. *No estimate*, in accordance with our expectations, carries a negative sign, and though the *unsigned* variable has a positive coefficient, it is not statistically significant. Finally, the artist's *reputation* variable, with a factor loading of 9.02, again is the most relevant hedonic variable for the art market.

The hedonic regression results for the Indian art market, displayed in Panel C of Table I, derive from 2,859 sales prices, which explain roughly 63% of the variation in prices during the period 2002 to 2008. All *auction house* variables are significant, other than Bonhams London, which does not set itself apart from the other auction houses. Consistent with the results for the Chinese art market, Christie's Hong Kong commands the highest prices. Our estimates for the *common media, materials, and combination* dummies also mirror the results for the Chinese art market. Oil on board thus seems to be a highly valued art format in Asia. As expected, the other combinations are not as highly valued, with negative coefficients. The *surface* variable is highly significant, though the factor loading is quite small, so the size of a painting appears less relevant in the Indian art market. The *no estimate* and *unsigned* dummies both reveal signs contrary to our expectations, but neither is significant. The *reputation* variable exhibits the correct sign and proves consistently strong and highly significant.

In Figure I, we display the art indices for Russia, China, and India, using end-of-year index values (January to December), though the 2008 index values are based only on January through April. Gray index values indicate that a certain time dummy coefficient resulting from the hedonic regression is significant, whereas black index values represent insignificant time dummies, which implies there is no significant price level change from one year to the next. The Russian art index exhibits enormous growth since its base year in 1985 (=100), though the index decreases from 1989 until 1991, in line with the 1990 downturn noted by De la Barre, Docclo, and Ginsburgh (1994) and Hodgson and Vorvink (2003). The Russian art index reaches its peak in 2007, at 985, and experiences a decline in the beginning of 2008, perhaps as a consequence of the deteriorating worldwide economic situation. However, this decline could also be the result of a substantial correction in the Russian art market that implies that the boom in Russian art came to an end.

< INSERT FIGURE I ABOUT HERE >

The middle graph shows that the highest point reached by the Chinese art index occurred nowhere near the rate indicated by Artprice in February 2008, which reported 780% growth since the beginning of 2001. A computation based on our constructed index results in a return of "just" 190% during the past seven years. In spring 2008, Sotheby's Hong Kong held three large Chinese contemporary art auctions, for which we can identify 102 contemporary artists that we match with our full data set. Solely on the basis of these Chinese contemporary artists and their accompanying

paintings, we estimate another hedonic regression to determine whether this excessive growth is reasonable, using 3,319 observations over the period 1990 to 2008. Although the empirical results (not reported here) show a somewhat lower R^2 of 0.62, the model is still quite strong in its ability to explain the price variability. The resulting Chinese contemporary art index clearly exhibits much stronger growth, with the index peaking at 364 in 2008, but it increased by "just" 330% since the beginning of 2001, not by the 780% reported by Artprice. This distinction is highly valuable for investors interested in the Chinese (contemporary) art market.

Artprice also reported in April 2008 an enormous increase of 830% for the Indian contemporary art market during the preceding decade. Although our Indian art index only extends to 2002, the bottom graph of Figure I suggests a similar growth pattern, with an increase of roughly 730% during the past seven years. This strong growth implies the Indian market is the most promising, but this implication should be interpreted with some caution, because the growth in price levels in the most recent three years (2006–2008) is not as strong as the preceding period. As a consequence, the time dummies for 2006 and 2007 indicate no significance.

Because all computations and estimations draw on the significance of the hedonic regressions, it is vital to know whether the resulting index results are stable. To test whether the indices are robust, we selected only top-level artists and built corresponding art price indices. Specifically, we chose the top 10%of the national art markets, determined by a multiple of their average sales prices and the number of paintings sold successfully, similar to the *reputation* variable. All quality characteristics for the hedonic variables remain the same. Despite some minor changes in the factor loadings, all regression results are fairly stable for the Russian, Chinese, and Indian art markets, in support of the robustness of our constructed art price indices. We note that the growth pattern for the top 10% index is significantly stronger than that of our original model, which indicates that performance consistently is higher for top-level artists across the three emerging art markets.

B. Optimal Asset Allocation

This section investigates whether investing in art yields a competitive, risk-adjusted return in comparison with other, more traditional asset classes, in which case it should be included in a well-diversified portfolio. In Table II, we provide the return statistics for the three emerging art market indices and all other asset classes in our sample. All observations use the end-of-year values. However, not all asset classes have the same number of observations. For China, the range of the SSE matches the Chinese art index, so the CAPM estimates in Panel B range from 1990 until 2008, whereas for India, the BSE stock index matches with the Indian art index, and the CAPM computations are based only on 2002–2008.

< INSERT TABLE II ABOUT HERE >

The return statistics show a Sharpe ratio of 0.32 for the Russian art market, in the middle of the three markets we study. Average returns on Russian art can compete with equity returns on the S&P

500, beating it by an average annualized geometric return of 0.77% during the period 1985–2008. The CAPM regression results in Panel B also demonstrate that Russian art has a rather high and positive, though non-significant, market beta of 0.65. Pairwise correlation results (not reported here) indicate that Russian art reveals a positive correlation with all but two asset classes, namely, Chinese stocks and commodities. According to these findings, Russian art does not make a very attractive investment.

The Chinese art market earns the lowest Sharpe ratio, 0.16, of all financial assets in our analysis. Its average annualized geometric return of 5.70% over the period 1990–2008 falls short of the returns to the SSE composite index and is low compared with the S&P 500 and three-month T-bill rate. Although the standard deviation of 21.08% is the lowest among the three emerging art markets, it is still higher than that for the S&P 500. The CAPM regression results in Panel B of Table II show that Chinese art has a negative market beta of -0.22. Moreover, the pairwise correlation analysis indicates that Chinese art exhibits a negative correlation with many other asset classes. The negative correlation of -0.21 between the Chinese art market and the S&P 500 indicates that investing in Chinese art represents a rather interesting investment alternative; in this case, Chinese art may be an excellent hedge during stock market downturns.

Table II also shows that the Indian art market exhibits the strongest geometric returns, with an annualized average value of 42.26% during 2002–2008. The CAPM regression results prove that Indian art has a negative market beta of -0.27, and the pairwise correlations indicate a correlation of almost zero with the S&P 500, which makes it a rather interesting investment for hedging purposes and portfolio diversification. However, these conclusions rely on just six years of annual data, which limits the computations. We exclude India from our subsequent empirical analyses.

For our analysis of the optimal asset allocation, we include the following assets: Russian art, Chinese art, Russian stocks, Chinese stocks, the S&P 500, three-month T-bills, ten-year Treasury bonds, corporate bonds, commodities, hedge funds, private equity, and real estate. Our framework builds not on a Markowitz (1952) portfolio but rather is based on (simple) power utility optimization. The optimization problem is denoted by

$$\max U_{avg} = \left(\sum_{t=0}^{n} \mathrm{E}_t \left[\frac{R^{1-\gamma}}{1-\gamma} \right] \right) \Big/ n , \tag{3}$$

where U_{avg} is the average utility over all time periods, R is the gross return on the portfolio, γ indicates the risk aversion parameter, and n is the number of time periods.

We consider every time interval as a scenario for returns on each asset. For each scenario, we calculate the utility, then sum those utilities and divide them by the number of time periods to obtain an average utility. To optimize this average utility, we alter the weights of the investment with the constraints of no short sales and all weights equal to 100%. We choose three risk aversion parameters: $\gamma = 2$ denotes low risk aversion, $\gamma = 5$ stands for average risk aversion, and $\gamma = 10$ indicates high risk

aversion. All series range from 1995 to 2008, so that we can include all asset classes. The results for the portfolio optimization appear in Table III.

< INSERT TABLE III ABOUT HERE >

Panel A of Table III displays the utility optimization results for the first scenario, in which we do not restrict the weights on each asset. In this case, art is never included, regardless of the value of the risk aversion parameter. We find strong results for the national stock indices and commodities, such that hedge funds attain a greater share as risk aversion increases. This finding seems rather astounding, considering the controversies surrounding hedge funds. Yet hedge funds provide a Sharpe ratio of 0.75 (see Table II). Corporate bonds provide a less risky alternative and are included at $\gamma = 10$.

Panel B further proves that when we constrain the weights to 15% per asset class, the art portfolio contains Chinese art but not Russian art at any value of the risk aversion parameter γ. These empirical results imply that investing in Chinese art leads to a higher utility and thus serves the purpose of optimal portfolio diversification. Most investment in Chinese art flows out of ten-year Treasury bonds and from corporate bonds, whereas the other portfolio weights remain practically unchanged. As risk aversion increases, Chinese art still in the optimal portfolio to a lesser degree. Our empirical findings thus indicate that the benefits of including emerging art markets in a well-diversified portfolio are rather limited.

Investing in art may offer an interesting alternative when stocks perform below average. We therefore analyze the downside risk characteristics of art as an asset class, following Ang, Chen, and Xing (2006), and compute the downside beta (β^-) as

$$\beta^- = \frac{\text{cov}(r_{i,}\, r_m \mid r_m < \mu_m)}{\text{var}(r_m \mid r_m < \mu_m)}, \tag{4}$$

where r_i equals the return of a particular asset i, r_m equals market return, and $r_m \mid r_m < \mu_m$ denotes the market return, given that the return is below the average market return. Thus, a negative downside beta indicates an opposite market movement: If the market provides negative returns, this particular asset will offer positive returns. In our case, though investing in art provides lower upside returns, it might still be attractive for a well-diversified portfolio because of this hedging opportunity. In Table IV, we provide the results of the downside risk analysis.

< INSERT TABLE IV ABOUT HERE >

Furthermore, from Table V, we note that Russian art has a downside beta almost equal to 0, meaning that its returns remain largely unexplained by stock market movements on the downside. The relatively weak annualized average downside geometric return of 4.33% nevertheless prevents its inclusion in an optimal portfolio. Chinese art has a downside beta of 0.43, meaning that it does not decline as strongly as the stock market. In combination with its return characteristics, such as the annualized average downside geometric return of 15.10% and its negative pairwise correlation with many other asset classes, this finding may explain why Chinese art appears, at least to a small degree,

in well-diversified portfolios. However, investing in art seems dominated by other asset classes. Even though art provides a reasonable return, there is little room for it in an optimal portfolio. Of course, the results of the utility optimization might turn in favor of art, such as by excluding the Russian and Chinese stock market indices and commodities. These asset classes exhibit highly volatile movements and are strongly influenced by temporary developments and market sentiment. Art thus might be included in an optimal portfolio, but the inclusion depends strongly on which asset classes an investor considers and whether the portfolio is constrained by asset weights.

C. *Art Markets and the Economic Environment*

Art is a luxury good, so if aggregate levels of wealth are high, the demand for art may increase as investors pursue it more. Changes in income should have a substantial effect on the demand and prices paid for artworks. Whereas financial markets are highly integrated with the economy and react quickly to economic shocks, the art market has a lower liquidity and incorporates value changes more slowly. Therefore, we posit that financial markets and (to a somewhat lesser extent) economic indicators function as leading indicators that predict the direction of the art market. In this section, we examine the potential long- and short-term relations between the Russian and Chinese art markets and financial markets, as well as indicators of economic activity. These possible linkages may help to explain price formations in the art market.

We first test for the existence of long-term linkages between pairs of variables, using Johansen's (1991) co-integration tests. Because the concept of co-integration is valid only for series that are integrated at an order of 1 or lower, we must conduct a series of unit root tests to determine whether the time series are stationary. The ADF unit root tests for Russia (not reported here) indicate that most series are I(1); only hedge funds and GDP are integrated higher than I(1). Therefore, we do not include these asset classes in our analysis of the Russian art market. In addition, for consistency, we differentiate all series for the subsequent co-integration analysis. The ADF test results indicate that most series are I(1) for China, and again, we differentiate the series. The series for CPI, American stocks, and hedge funds do not appear in our analysis of the Chinese art market because of their higher order of integration.

Co-integration in our setting indicates a significant, long-term relation between art prices and other financial time series. The resulting two-equation VAR may be specified as a vector error correction model (VECM):

$$\Delta art_t = \alpha_1 + \delta_1(\sum_{i=1}^{n} \gamma_i \Delta art_{t-i}) + \sum_{i=1}^{n} \beta_i \Delta x_{t-i} + \varepsilon_{1,t}, \text{ and}$$

$$\Delta x_t = \alpha_2 + \delta_2(\sum_{i=1}^{n} \gamma_i \Delta x_{t-i}) + \sum_{i=1}^{n} \beta_i \Delta art_{t-i} + \varepsilon_{2,t}, \quad (5)$$

where Δart_t and Δx_t stand for the dependent variables in first differenced series, α is the intercept of the model, δ is the error correction coefficient, γ is the coefficient value for the lags within the error correction part of the VAR model, β is the coefficient value for the other specified lags, ε is the disturbance term, n refers to the number of lags, t is the time period, and the variable x determines the respective time series other than the art market index. We exhibit the results for the Johansen co-integration analysis in Table V.

< INSERT TABLE V ABOUT HERE >

In Panel A of Table V, we note fairly strong results for the Russian co-integration test, as indicated by both the eigenvalue and trace statistics. When we change the number of lags, the significance of the co-integration tests remains robust. All but two co-integration tests are significant; the hypothesis $r \leq 1$ cannot be rejected for the Russian CPI and its national stock index. We might have expected to find that these two economic indicators represent driving forces for price formation on the Russian art market, but the weaker relation of Russian art to its national CPI may reflect the stronger influence of other factors, such as Russian GDP. The relatively minor influence of the CPI level thus might not be visible. The weaker relation between the RTS index and the Russian art market may occur because different investor sentiments influence these markets. Frey and Eichenberger (1995) argue, for example, that stock markets tend to respond with the greatest volatility to unexpected news, whereas the art market is subject to fashion, tastes, and booming markets, regardless of other economic developments, which means the two markets should be at least partially segregated. However, all other financial time series exhibit strong co-integration with the Russian art index over the long term. It seems that the Russian art index is driven mostly by international financial markets and, to a somewhat lesser degree, by its own domestic economic environment.

Panel B in Table V indicates similarly strong results for the Chinese series. All co-integration tests are significant, and the development of Chinese GDP growth and its domestic stock market have significant long-term impacts on the art market. Our empirical findings of significant long-term relationships among the Russian and Chinese art markets, financial markets, and indicators of economic activity contradict results proffered by Chanel (1995), Ginsburgh and Jeanfils (1995), and Kraeussl and Roelofs (2008), who find no long-term relationships between the art market and the economy. However, our empirical findings might reflect the continued immaturity of the Russian and Chinese art markets.

In a final step, we employ Granger (1969) causality tests to examine the short-term relations between the art market and the economic environment. We intuitively expect that in the short-term, art markets, which are less liquid than other asset classes, reflect variables such as the stock market. In contrast, real estate should be more time-lagged than art, such that the relation should be opposite.

The simple causal model specified in first differences is

$$\Delta x_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1,i} \Delta x_{t-i} + \sum_{i=1}^{n} \gamma_{1,i} \Delta art_{t-i} + \varepsilon_{1,i} \ , \quad \text{and}$$

$$\Delta art_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2,i} \Delta x_{t-i} + \sum_{i=1}^{n} \gamma_{2,i} \Delta art_{t-i} + \varepsilon_{2,i} \ , \qquad (6)$$

with the same notations as those for Equation (5), with the exception of the absence of the VECM correction mechanism.

The results for the Granger causality analysis appear in Table VI. For consistency in representation, the number of lags specified for the causality measure equals the number indicated in the co-integration analysis. The results for the short-term linkages between the art market and its economic environment are very weak. Two significant relationships emerge for Russia, but none do for China. The S&P 500 Granger influences the Russian art index at the 5% significance level, and art affects ten-year Treasury bonds at the 5% level when the model is specified at one lag. However, sensitivity checks (not reported here) show that these results are not robust across different lags, such that when we increase the lags beyond one, the empirical findings become insignificant.

< INSERT TABLE VI ABOUT HERE >

The weak short-term Granger causality results for the Russian and Chinese art markets might result from the current state of these booming art markets, for which the behavior will change as the markets mature and conform to the patterns of more established national art markets. Because of these highly volatile time series, short-term causality among emerging art markets, financial markets, and domestic indicators of economic activity is lacking. Chanel (1995), Ginsburgh and Jeanfils (1995), and Kraeussl and Roelofs (2008) all find significant relations in the short-term and none on the long-term, but they analyze established art markets.

These weak short-term relations between emerging art markets and the economy also may emerge because our indices and computations rely on annual data. Kraeussl and Roelofs (2008) apply both semi-annual and quarterly data and find that, aside from the significant short-term relations established among the art market, GDP, and CPI, their quarterly data indicate a significant, bidirectional relation between art and real estate. Therefore, our results could be subject to specification issues. Regrettably, a semi-annual index, let alone a quarterly index, could not be specified for the emerging art markets of Russia, China, and India due to the lack of data availability.

IV. Conclusions

Investors constantly hunt for alternative assets that might improve the risk-adjusted returns on their financial portfolios. When stock markets experience a downswing, investors search for more profitable alternatives. Financial newspapers fill headlines with record prices paid for certain works of art, giving rise to the idea that investing in art might be a profitable pursuit. Moreover, Artprice recently reported a booming emerging art market for Russia, 780% growth for the Chinese

(contemporary) art market since 2001, and 830% growth for the Indian (contemporary) art market in the past decade. To determine if these reported returns are feasible and indicate reasonable investment alternatives, we analyze whether investing in emerging art markets yields a competitive risk-adjusted return in comparison with other, more traditional asset classes that could be used optimally to diversify a financial portfolio.

On the basis of auction sales prices from *Artnet.com*, we estimate three hedonic regression models and build a Russian (1985–2008), a Chinese (1990–2008), and an Indian (2002–2008) art market index. All three indices demonstrate strong growth. The Russian art index rose from 100 in 1985 to 895 in 2008, after reaching its peak of 985 in 2007. China exhibits the weakest growth, with a rise from 100 in 1990 to its peak of 271 in 2008. India similarly reaches its peak in the beginning of 2008, at 829, in support of the growth reported by Artprice. Because our art market results for China seem comparatively weak and the existing reports attribute 780% growth to Chinese *contemporary* art, we run another model for contemporary artists alone. These artists enjoy stronger growth, from 100 to 364. In summary, in comparison with other asset classes, these three emerging art markets perform reasonably well.

The Chinese art market, though it does not beat the S&P500, has a negative market beta and a negative correlation with many asset classes, which makes it an interesting investment option. Russia does not share these characteristics—it reveals a positive market beta and a positive correlation with most other assets—yet the market still beats the S&P 500. India exhibits the strongest Sharpe ratio of all three emerging art markets and by far the strongest average annual return. Moreover, the Indian art index has a negative market beta and a nearly zero correlation with the S&P 500, which makes it another interesting investment for a well-diversified portfolio.

To determine the potential diversification benefits of art investments, we use power utility as the optimization framework. Our optimal asset allocation results show that when we apply no constraints to the asset weights, art would never be included in a well-diversified portfolio. However, when we constrain the weights to 15%, Chinese art occupies a small place within the optimal portfolio at all risk aversion levels. That is, according to certain decision rules, investing in Chinese art offers diversification benefits. This view is strengthened by the downside beta of 0.42, which means that the Chinese art index moves less strongly with the S&P 500 in the case of a downturn and provides a possible hedging alternative.

Next, to determine the link between art and the economy, we applied Johansen's co-integration and Granger's causality techniques. The co-integration results are strong and indicate that in the long term, emerging art markets experience a significant relation with other financial markets and are indicators of economic activity. In contrast, short-term results based on Granger causality tests are very weak. The only significant short-term relations are the effect of the S&P 500 on the Russian art index and the influence of Russian art on the ten-year U.S. Treasury bond rate. The high volatility of the Russian and Chinese art market indices may make such stable short-term relations impossible.

A potential investor undoubtedly would be interested in whether previously exhibited patterns will persist in the future. Yet none of these three emerging art markets has had time to mature, and they continue to increase in popularity and size. The currently steady growth of the Russian, Chinese, and Indian art market indices might change in the future. Artprice recently mentioned that its global art index plunged by 7.5% in the first quarter of 2008. In the upper graph in Figure I, the Russian art market similarly experienced a decline in 2008. Sales continue to be strong at different auctions, but there is a growing consensus that growth in the Russian art market will slow. Whereas the focus has been on quantity, during recent auctions, it has shifted to quality, indicating that the Russian art market is maturing. The Chinese art market likely will grow for a little longer; the number of auctions containing Chinese artworks continues to increase, China recently took over from France as the third-largest art market in the world, and 15 of the 35 contemporary artists who sold works for more than $1 million in 2008 were Chinese. Finally, judging the future direction of the Indian art market is even more difficult; though price levels since 2006 have been fairly flat, this market is still very young and has significant growth potential.

Investing in art is very different from investing in common stock and bonds. First, stocks and bonds offer a return in the form of dividend or interest, whereas art, as a consumer good, provides the owner with aesthetic pleasure and social status. Second, stock and bond markets are characterized by greater liquidity and almost continuous trading, whereas the time between a purchase and the sale of a particular painting often takes many years. Third, owning art has additional risks, including theft, forgery, and possible damages. We conclude that investing in art is not an effective, purely financial investment. Artwork, unlike assets such as stocks, bonds, real estate, and certain investment funds, should be kept for the enjoyment of its aesthetic returns as well.

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Table I

Hedonic Regression Results

Table I displays the hedonic regression results for the Russian (1985–2008), Chinese (1990–2008), and Indian (2002–2008) art markets. The dependent variable is Ln(Price). The reference artists chosen for Russia, China, and India are Marc Chagall, Zao Wou-Ki, and Francis Newton Souza, respectively. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

A. Russia (1985–2008)						
	Coefficient		S.E.	Prob.		Signif.
Artus, Gridel & Boscher	0.3875		0.0230	0.0000		***
Christie's London	1.1834		0.0391	0.0000		***
Christie's NY	0.9966		0.0435	0.0000		***
Christie's SK	-0.2912		0.0307	0.0000		***
Gros & Delettrez	0.2080		0.0256	0.0000		***
Millon & Robert	0.2988		0.0222	0.0000		***
Rabourbin & Choppin	0.4178		0.0233	0.0000		***
Sotheby's London	0.8150		0.0288	0.0000		***
Sotheby's NY	1.0456		0.0327	0.0000		***
Acrylic on Canvas	-0.6960		0.0604	0.0000		***
Mixed Media	-0.0450		0.0945	0.6343		
Oil on Board	0.1959		0.0194	0.0000		***
Oil on Cardboard	0.1253		0.0381	0.0010		***
Oil on Panel	0.1051		0.0303	0.0005		***
Oil on Paper	0.3337		0.0775	0.0000		***
Tempera on Paper	0.0339		0.1213	0.7802		
Other	0.1172		0.0162	0.0000		
No Estimate	0.2120		0.0235	0.0000		***
Ln(Surface)	0.3020		0.0064	0.0000		***
Unsigned	-0.0150		0.0271	0.5802		
Ln(Reputation)	7.1670		0.0455	0.0000		***
Intercept	-22.7517		0.2043	0.0000		***
Adjusted R2	0.8426	S.E. of Regr.	0.9130	Obs. 24,524	F-stat.	2,977.8
B. China (1990–2008)						
Christie's HK	0.4235		0.0293	0.0000		***
Christie's NY	0.2881		0.0928	0.0019		***
Poly International	0.1434		0.0371	0.0001		***
Ravenel	0.1667		0.0505	0.0010		***
Sotheby's HK	0.2402		0.0350	0.0000		***
Sotheby's NY	0.0118		0.0363	0.7452		
Acrylic on Canvas	-0.2383		0.0479	0.0000		***
Ink and Colour	-0.4356		0.0452	0.0000		***
Mixed Media	-0.2747		0.1076	0.0107		**
Oil on Board	0.3135		0.0660	0.0000		***
Oil on Paper	-0.4204		0.1173	0.0003		***
Other	-0.1891		0.0300	0.0000		***
No Estimate	-0.2864		0.1641	0.0811		*
Ln(Surface)	0.2696		0.0108	0.0000		***
Unsigned	0.0295		0.0335	0.3789		
Ln(Reputation)	9.0177		0.0999	0.0000		***
Intercept	-31.6640		0.4629	0.0000		***
Adjusted R2	0.6997	S.E. of Regr.	0.8559	Obs. 7,172	F-stat.	492.42
C. India (2002–2008)						
Bonhams London	0.0265		0.0958	0.7824		
Christie's HK	0.2048		0.0793	0.0099		***
Christie's NY	0.2200		0.0573	0.0001		***
Saffronart	0.1531		0.0540	0.0046		***
Sotheby's London	0.1517		0.0860	0.0778		*
Sotheby's NY	0.1413		0.0580	0.0149		**
Acrylic on Canvas	-0.0761		0.0437	0.0818		*
Mixed Media	-1.0583		0.0798	0.0000		***
Oil on Board	0.3726		0.0667	0.0000		***
Other	-0.4582		0.0402	0.0000		***
No Estimate	0.4913		0.3670	0.1807		
Ln(Surface)	0.0773		0.0157	0.0000		***
Unsigned	0.0089		0.0579	0.8778		
Ln(Reputation)	9.9813		0.1932	0.0000		***
Intercept	-34.9299		0.8911	0.0000		***
Adjusted R2	0.6297	S.E. of Regr.	0.8045	Obs. 2,859	F-stat.	241.34

Table II

Return Statistics

Table II presents the return statistics for all selected asset classes. Panel A shows the general descriptive statistics, based on all observations available between 1986 and 2008, other than national stock indices, which are matched with the corresponding art indices. All returns, medians, maximums, minimums, and standard deviations appear in percentages. Panel B presents the results of the CAPM analysis, for which the CAPM estimations are based on excess returns: $R_i - r_f = \beta_i (R_m - r_f)$, where the S&P500 represents the market return and the three-month T-bills represent the risk-free rate. All returns are simple returns. Probability values appear in parentheses.

A. Descriptive Statistics

	Art Russia	Russian Stocks	Art China	Chinese Stocks	Art India	Indian Stocks	S&P 500	10y T. Bond	3m T-bills	Corp. Bonds	Commodities	Hedge Funds	Private Equity	Real Estate
Arithm. Return	12.67	47.54	7.72	45.83	46.29	35.46	10.19	5.96	4.32	8.88	134.01	11.47	11.76	13.67
Geom. Return	10.00	25.77	5.70	21.73	42.26	33.08	9.23	4.30	5.94	8.68	6.96	11.09	8.53	11.04
Median	6.11	43.23	8.33	4.35	52.91	31.27	11.38	5.77	4.85	8.64	14.00	9.47	13.78	9.14
Maximum	96.19	197.42	50.66	472.24	98.30	69.53	33.20	9.11	8.07	30.13	799.13	26.50	58.66	101.42
Minimum	-30.49	-85.15	-31.15	-49.01	-0.03	-5.78	-15.31	3.68	0.90	-1.91	-97.94	-4.41	-32.81	-29.59
Std. Dev.	26.53	69.61	21.08	117.80	36.87	27.16	14.58	1.65	2.00	6.94	260.28	9.56	27.03	26.42
Sharpe Ratio	0.32	0.62	0.16	0.35	1.14	1.15	0.40	1.00	-	0.66	0.50	0.75	0.28	0.35
Skewness	1.62	0.37	-0.00	2.81	-0.03	-0.16	-0.32	0.43	-0.09	0.96	1.32	0.11	-0.11	1.39
Kurtosis	3.36	3.27	2.49	10.79	1.85	2.08	2.01	2.04	2.26	5.01	3.54	2.03	2.08	6.46
JB	14.41	0.36	0.20	69.19	0.33	0.24	1.32	1.59	0.55	7.38	6.98	0.58	0.52	18.85
Prob.	0.03	0.83	0.91	0.00	0.85	0.89	0.52	0.45	0.76	0.02	0.03	0.75	0.77	0.00
Obs.	23	14	18	18	6	6	23	23	23	23	23	14	14	23

B. CAPM

	Art Russia	Russian Stocks	Art China	Chinese Stocks	Art India	Indian Stocks	S&P 500	10y T. Bond	3m T-bills	Corp. Bonds	Commodities	Hedge Funds	Private Equity	Real Estate
Intercept	0.0453	0.4073	-0.0179	0.3446	0.4434	1.2767	-	0.0184	-	0.0432	1.2514	0.0617	0.0212	0.0378
	(0.5753)	(0.0063)	(0.4569)	(0.2041)	(0.0569)	(0.0001)	-	(0.0000)	-	(0.0176)	(0.0275)	(0.0041)	(0.7592)	(0.4087)
Beta	0.6526	0.5318	-0.2166	1.4771	-0.2681	1.8633	-	-0.0333	-	0.0426	0.7756	0.2856	0.9929	0.9488
	(0.1486)	(0.7403)	(0.4547)	(0.2203)	(0.8587)	(0.0938)	-	(0.0502)	-	(0.7278)	(0.8145)	(0.0554)	(0.0189)	(0.0255)
R-squared	0.1142	0.0126	0.0626	0.0270	0.0063	0.5757	-	0.1354	-	0.0064	0.0017	0.2216	0.3148	0.2472
F-statistic	2.7085	0.1530	1.0679	0.4435	0.0253	5.4263	-	3.2891	-	0.1355	0.0360	3.4155	5.5128	6.8971
S.E. of regression	0.2577	0.7155	0.1132	1.1981	0.4035	0.1915	-	0.0119	-	0.0753	2.6558	0.0813	0.2226	0.2348

Table III

Optimal Asset Allocation

Table III exhibits the results for the optimal asset allocation analysis based on (simple) power utility optimization: $maxU_{avg} = (\sum E_t [R^{1-\gamma} / 1-\gamma]) / n$. The period used for the optimization runs from 1995 to 2008. The optimization assumes that no short sales are allowed and all weights must add up to 100%. The utility refers to the portfolio over the entire period, as does the standard deviation. All weight values are given in percentages.

A. Weights Unconstrained

	Art Excluded			***Art Included***		
	$\gamma = 2$	$\gamma = 5$	$\gamma = 10$	$\gamma = 2$	$\gamma = 5$	$\gamma = 10$
Art Russia	0.00	0.00	0.00	0.00	0.00	0.00
Art China	0.00	0.00	0.00	0.00	0.00	0.00
Russian Stocks	33.49	20.92	14.30	33.49	20.92	14.30
Chinese Stocks	32.11	10.58	3.75	32.11	10.58	3.75
S&P 500	0.00	0.00	0.00	0.00	0.00	0.00
3m T-bills	0.00	0.00	0.00	0.00	0.00	0.00
10y Treas. Bonds	0.00	0.00	0.00	0.00	0.00	0.00
Corp. Bonds	0.00	0.00	21.11	0.00	0.00	21.11
Commodity	17.32	3.87	1.06	17.32	3.87	1.06
Hedge Funds	9.36	64.63	59.78	9.36	64.63	59.78
Private Equity	0.00	0.00	0.00	0.00	0.00	0.00
Real Estate	7.73	0.00	0.00	7.73	0.00	0.00
Utility	-0.7949	-0.1391	-0.0397	-0.7949	-0.1391	-0.0397
St.dev.	0.5873	0.2282	0.1236	0.5873	0.2282	0.1236

B. Weights 15%

	Art Excluded			***Art Included***		
	$\gamma = 2$	$\gamma = 5$	$\gamma = 10$	$\gamma = 2$	$\gamma = 5$	$\gamma = 10$
Art Russia	0.00	0.00	0.00	0.00	0.00	0.00
Art China	0.00	0.00	0.00	6.00	3.90	3.52
Russian Stocks	15.00	15.00	15.00	15.00	15.00	14.03
Chinese Stocks	15.00	15.00	7.97	15.00	15.00	6.85
S&P 500	13.56	15.00	15.00	15.00	15.00	15.00
3m T-bills	0.00	0.00	0.00	0.00	0.00	0.00
10y Treas. Bonds	0.00	3.63	15.00	0.00	0.00	13.55
Corp. Bonds	11.44	15.00	15.00	4.00	15.00	15.00
Commodity	15.00	6.37	2.03	15.00	6.10	2.06
Hedge Funds	15.00	15.00	15.00	15.00	15.00	15.00
Private Equity	0.00	0.00	0.00	0.00	0.00	0.00
Real Estate	15.00	15.00	15.00	15.00	15.00	15.00
Utility	-0.8156	-0.1440	-0.0448	-0.8154	-0.1436	-0.0447
St.dev.	0.4461	0.2477	0.1481	0.4498	0.2436	0.1437

Table IV

Downside Risk

Table IV presents the results for the downside risk measurement. All downside betas are calculated on the basis of excess returns over the three-month T-bill rate. The S&P 500 is an indicator of the general stock market return. The computation is given by $\beta^{-} = cov(r_i, r_m \mid r_m < \mu_m) / var(r_m \mid r_m < \mu_m)$. Both downside returns are excess returns. All returns are given in percentages.

	Downs. Return	Downs. Geom. Return	β^{-}	Prob.	R2
Art Russia	4.85	4.33	0.0319	0.9559	0.0004
Russian Stocks	25.32	23.60	-1.5324	0.2920	0.2287
Art China	17.17	15.10	0.4283	0.8121	0.0170
Chinese Stocks	-1.65	-5.81	0.4975	0.8593	0.0121
S&P 500	-8.29	-8.52	1.0000	0.0000	1.0000
10y Treas. Bonds	2.01	2.00	-0.1966	0.0275	0.7527
Corp. Bonds	5.41	5.14	-0.7226	0.1803	0.4013
Commodities	127.69	18.34	8.6269	0.6747	0.0575
Hedge Funds	4.39	4.29	0.1455	0.6422	0.1455
Private Equity	-5.44	-9.47	3.6075	0.0747	0.6211
Real Estate	1.94	0.77	0.4462	0.7496	0.0346

Table V

Co-integration Analysis

Table V exhibits the results for the Johansen co-integration test. Based on the unit root test, certain variables were excluded. The model is specified as $\Delta art_t = \alpha_1 + \delta_1(\sum\gamma_i\Delta art_{t-i}) + \sum\beta_i\Delta x_{t-i} + \varepsilon_{1,t,}\ \Delta x_t = \alpha_2 + \delta_2(\sum\gamma_i\Delta x_{t-i}) + \sum\beta_i\Delta art_{t-i} + \varepsilon_{2,t}$. The ranges are from 1986 to 2008 and 1991 to 2008 for Russia and China, respectively. The number of lags depends on the eigenvalue and trace test statistics. Results are strong in general, with only two insignificant long-term relations, as indicated by ‡. [a] MacKinnon, Haug, and Michelis (1999) *p*-values.

A. Russia

	H0	H1	Lags	Eigenvalue	Trace Statistic	5% Critical	Prob. [a]
CPI	r = 0	r > 0	2	0.7644	21.4022	15.4947	0.0057
	r ≤ 1	r > 1		0.1820	2.6110	3.8415	‡0.1061
Russian Stock Index	r = 0	r > 0	1	0.7072	17.4232	15.4947	0.0253
	r ≤ 1	r > 1		0.2004	2.6833	3.8415	‡0.1014
S&P 500	r = 0	r > 0	1	0.5552	22.5467	15.4947	0.0037
	r ≤ 1	r > 1		0.2317	5.5355	3.8415	0.0186
10y Treasury Bonds	r = 0	r > 0	1	0.6285	35.5870	15.4947	0.0000
	r ≤ 1	r > 1		0.5056	14.7907	3.8415	0.0001
3m T-bills	r = 0	r > 0	1	0.5511	26.0082	15.4947	0.0009
	r ≤ 1	r > 1		0.3544	9.1877	3.8415	0.0024
Corporate Bonds	r = 0	r > 0	1	0.5759	24.1864	15.4947	0.0019
	r ≤ 1	r > 1		0.2548	6.1752	3.8415	0.0130
Commodities	r = 0	r > 0	1	0.5878	32.2886	15.4947	0.0001
	r ≤ 1	r > 1		0.4786	13.6763	3.8415	0.0002
Private Equity	r = 0	r > 0	3	0.9982	76.5389	15.4947	0.0000
	r ≤ 1	r > 1		0.4751	7.0907	3.8415	0.0000
Real Estate	r = 0	r > 0	1	0.6491	30.7826	15.4947	0.0001
	r ≤ 1	r > 1		0.3420	8.7902	3.8415	0.0030

B. China

Name	H0	H1	Lags	Eigenvalue	Trace Statistic	5% Critical	Prob. [a]
GDP	r = 0	r > 0	4	0.6892	27.7394	15.4947	0.0005
	r ≤ 1	r > 1		0.6191	12.5476	3.8415	0.0004
Chinese Stock Index	r = 0	r > 0	1	0.7161	30.6130	15.4947	0.0001
	r ≤ 1	r > 1		0.4801	10.4661	3.8415	0.0012
10y Treasury Bonds	r = 0	r > 0	2	0.6286	27.5625	15.4947	0.0005
	r ≤ 1	r > 1		0.5192	11.7163	3.8415	0.0006
3m T-bills	r = 0	r > 0	2	0.5605	20.9712	15.4947	0.0068
	r ≤ 1	r > 1		0.3865	7.8184	3.8415	0.0052
Corporate Bonds	r = 0	r > 0	1	0.6929	26.0974	15.4947	0.0009
	r ≤ 1	r > 1		0.4284	8.3892	3.8415	0.0038
Commodities	r = 0	r > 0	1	0.7919	32.4852	15.4947	0.0002
	r ≤ 1	r > 1		0.4180	8.1187	3.8415	0.0044
Private Equity	r = 0	r > 0	2	0.6824	23.9577	15.4947	0.0021
	r ≤ 1	r > 1		0.5014	9.0470	3.8415	0.0026
Real Estate	r = 0	r > 0	4	0.7358	26.9744	15.4947	0.0006
	r ≤ 1	r > 1		0.2988	5.6798	3.8415	0.0172

Table VI

Causality Test Results

Table VI shows the Granger short-term causality results for the Russian and Chinese art indices, using the same variables as in the Johansen co-integration tests and the same number of lags. The model is specified as $\Delta x_t = \alpha_1 + \sum\beta_{1,i}\Delta x_{t-i} + \sum\gamma_{1,i}\Delta art_{t-i} + \varepsilon_{1,t}$, $\Delta art_t = \alpha_2 + \sum\beta_{2,i}\Delta x_{t-i} + \sum\gamma_{2,i}\Delta art_{t-i} + \varepsilon_{2,t}$. The null and alternative hypotheses are given as H0: The art index is not caused by 'name,' and 'name' is not caused by art index; H1: The art index is caused by 'name,' and 'name' is caused by art index. ** indicates significance at the 5% level.

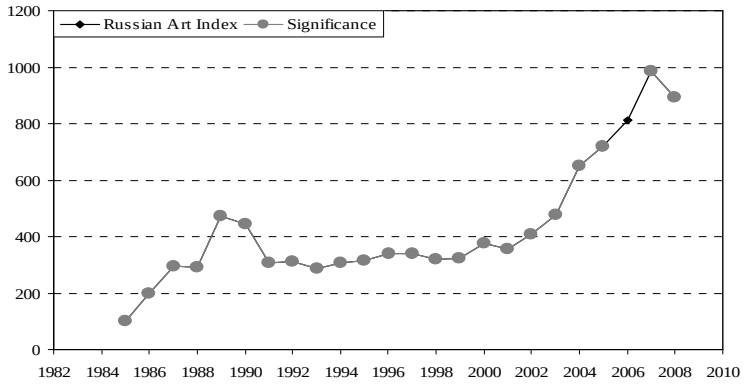
A. Russia

		F-statistic			F-statistic
CPI	Art Index	1.7867	Art Index	CPI	2.0737
		(0.2061)			(0.1754)
Russian Stock Index	Art Index	0.0201	Art Index	Stock Index	0.1422
		(0.8902)			(0.7140)
S&P500	Art Index	5.7725	Art Index	S&P500	0.6205
		**(0.0267)			(0.4406)
10y Treasury Bonds	Art Index	0.4102	Art Index	10y Treasury Bonds	6.0678
		(0.5295)			**(0.0235)
3m T-bills	Art Index	2.0195	Art Index	3m T-bills	0.1876
		(0.1715)			(0.6698)
Corp. Bonds	Art Index	1.1643	Art Index	Corp. Bonds	0.3395
		(0.2941)			(0.5670)
Commodities	Art Index	0.0005	Art Index	Commodities	0.0495
		(0.9820)			(0.8263)
Private Equity	Art Index	2.2466	Art Index	Private Equity	0.4234
		(0.2008)			(0.7448)
Real Estate	Art Index	0.2835	Art Index	Real Estate	0.8491
		(0.6006)			(0.3684)

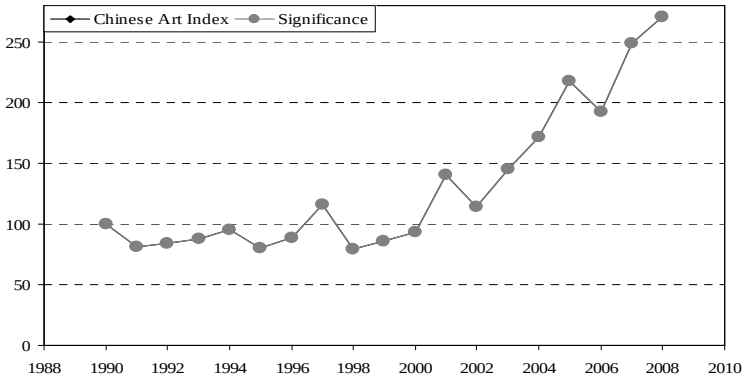
B. China

		F-statistic			F-statistic
GDP	Art Index	0.4351	Art Index	GDP	0.6726
		(0.6579)			(0.5302)
Chinese Stock Index	Art Index	0.01559	Art Index	Stock Index	1.3127
		(0.9024)			(0.2711)
10y Treasury Bonds	Art Index	0.0603	Art Index	10y Treasury Bonds	0.9023
		(0.8096)			(0.3583)
3m T-bills	Art Index	0.1882	Art Index	3m T-bills	0.0154
		(0.6711)			(0.9032)
Corp. Bonds	Art Index	0.8902	Art Index	Corp. Bonds	0.7312
		(0.4382)			(0.5033)
Commodities	Art Index	1.0565	Art Index	Commodities	0.2213
		(0.3214)			(0.6453)
Private Equity	Art Index	1.0205	Art Index	Private Equity	0.1035
		(0.3341)			(0.7537)
Real Estate	Art Index	2.8789	Art Index	Real Estate	0.3187
		(0.1119)			(0.5814)

Russian Art Market Index (1985–2008)



Chinese Art Market Index (1990–2008)



Indian Art Market Index (2002–2008)

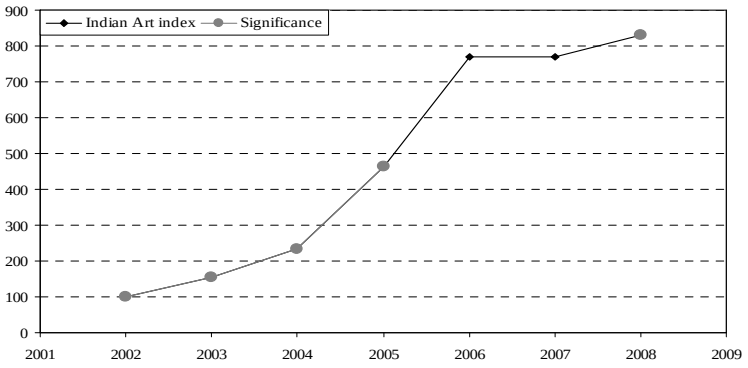


Figure I: Emerging Art Market Indices. Figure I illustrates the Russian (1985–2008), Chinese (1990–2008), and Indian (2002–2008) art market indices. Grey points indicate the significance of the time dummies in the hedonic regressions. The patterns of the three emerging art market indices appear quite diverse, but both Russia and China decline around 1990 and increase after 2000. India shows a very strong incline from 2002 to 2006, but since then, the Indian art index appears largely flat, such that 2006 and 2007 are insignificant.