INVESTMENT RETURNS AND RISK FOR ART: EVIDENCE FROM AUCTIONS OF AMERICAN PAINTINGS

Richard J. Agnello
University of Delaware

INTRODUCTION

Numerous economic studies have attempted to empirically document the profitability of investment in various collectibles including coins, violins, wine, antique furniture, and paintings. With profitability information, the collector will have some idea of the expected consumption cost of collecting (the residual between alternative financial returns and those of the collectible), and thus be in a better position to make a purchase decision. This study contributes to this economic literature by focusing on a rather expensive collectible, paintings by well-known U.S. artists. This paper extends previous analyses of returns and adds results on risk, a topic receiving less attention in earlier studies. The empirical analysis is based on data from over 25, 000 paintings by U.S. artists sold at auction from 1971 to 1996. Following Chanel, et al. [1996] I use a hedonic log price model. Dummy variables that reflect temporal, spatial, and characteristic variations allow the simultaneous estimation of price indices for paintings and shadow values for spatial and other characteristics. The analysis is disaggregated and focuses on individual artists, genres and quality levels. The findings show significant sensitivity of both returns and risk to the particular segment of the painting market. When and what one invests in matters a great deal just as it does in traditional financial markets. Overall returns are lower than equity markets and risk is greater although high-end paintings do well. The early 1990s were quite bearish although some painting sectors recovered significantly by 1996. Art may play a potential diversification role for the collector/investor even though returns and risk alone are not generally appealing.

Collecting

Collecting has become an increasingly popular activity. Rather than being an idiosyncratic, and perhaps pathological consumption activity, which represents an exception to neoclassical economics [Viner, (1925) 1968], collecting may be a central paradigm in economics [Bianchi, 1997]. Luxury consumption in general and collecting in particular by the wealthy are not recent phenomena. Increases in wealth and leisure time for the overall populace, however, have made the pursuit of luxury a

Richard J. Agnello: Department of Economics, University of Delaware, Newark, DE 19716. E-mail: agnellor@be.udel.edu

Eastern Economic Journal, Vol. 28, No. 4, Fall 2002

mainstream economic and social phenomenon. Some writers argue that this luxury spending boom has reached "fever" proportions [Frank, 1999]. Sociologists argue that the conquest of material scarcity, at least in first-world countries, strains the foundations of neoclassical economics [Hirsch, 1976]. Collecting as a particular form of luxury consumption may violate traditional price determination if perceived rarity is a determinant of demand [Koford and Tschoegl, 1998].

Another factor contributing to widespread collecting is the perception that one's collection may increase in value over time so as to offer investment potential. Collecting thus affords the opportunity of acquiring both a rare consumption good and a potentially profitable asset. Since collectibles yield psychic returns to their owner, one would expect the profitability or return to holding collectibles to be less than that of noncollectible assets such as stocks and bonds. The difference in these returns reflects the cost of collecting and may be large. For this reason a financial investor who does not experience the psychic rewards of collecting will not likely profit from investment in collectibles, unless he is lucky. In a world of rational arbitrating agents, any other finding would be surprising since consumption has its price. The paper by Singer and Lynch [1997] where "investment" art (that is, the highest quality) is found to result in a zero consumption cost is likely a temporal aberration unless offset by higher risk. If zero consumption cost for really great art were to persist, a permanent free lunch rather than one that is transitory (that is, random) would exist [Frey, 1998].

Fine arts and especially paintings with prices soaring into the tens of millions of dollars for single works are perhaps the most spectacular collector goods. Notwithstanding recessionary cycles, the popular perception persists that the return to investment in paintings compares favorably with traditional financial alternatives. The sharp decline in painting auction prices after the peak in 1989 tempered this view somewhat, but the 1990s have witnessed a resurgence, although not universally. The favorable impression of art investment is frequently supported by spectacular individual examples. In 1990 Renoir's "At the Moulin de la Gattele" sold for over $78 million and setting an all-time record, Van Gogh's "Portrait of Dr. Gachet," sold for over $82 million. Although the world was stunned by these high prices, the rate of return on these works, while respectable, was less spectacular. Frey and Pommerehne [1988] estimate that Van Gogh's "Sunflowers" and "Irises", which auctioned in 1987 for just under $40 and $54 million, yielded nominal annual rates of return of 11 and 12 percent respectively.

Economic Literature

In contrast to the anecdotal evidence on returns economic studies of painting investment have not supported claims of financial success. In spite of differences due to subject matter, time frames and empirical methodologies, the conclusions are generally the same. Paintings not only have a lower return than financial alternatives such as stocks and bonds, but they are also a riskier and thus a decidedly inferior investment choice.

The long-run real returns to art holding, although found to be low, appear to be generally positive. Factoring in the costs associated with special risks inherent in fine art such as fire, theft, mutilation, forgeries, climate control, and mistaken attribution worsens the investment picture, but it still likely remains positive. Frey and Pommerehne [1988] estimate fire and theft insurance costs to range from 0.2 to 1.0 percent of a painting's value per year. Thus, although not attractive from an investment view, art may nevertheless represent an attractive good for the wealthy consumer since few consumption goods retain real value over long periods. Tax benefits associated with charitable donations of art may also be of considerable value for the wealthy [Frey, 1997]. The broad conclusions of low economic rates of return and high risk to investment in the arts should not discourage an investigation of what determines these returns and how they differ across time periods, locations, genre, artists, quality levels, etc.

Frey and Eichenberger [1995] review early studies while Burton and Jacobsen [1999] update and broaden the review to include collectibles with the same overall pessimistic conclusions. Here, we review a few additional recent articles. Pesando and Shum [1999] update an earlier study by Pesando [1993] on Picasso prints using repeat sale auction data from 1977 to 1996. They find prices peaking in 1990 followed by a sharp drop-off. Notwithstanding a modest recovery in the mid-1990s, the annual real rate of return for the period remains low (1.5 percent) and is even beneath U.S. Treasury bills (2.3 percent). Furthermore, the variance of their print returns greatly exceeds U.S. Treasury bills and even exceeds that of stocks. As in the earlier study, painting returns are found to correlate very weakly with those of stocks and bonds, and thus may provide some diversification value in the investor's portfolio.

Biey and Zanola [1999] perform a short-run analysis from 1987 to 1995 taking auction fees into account and using repeat sales from international auction data. They find that real prices rose rapidly until 1990 and then fell back below 1987 levels by 1995 with a brief upturn in 1993. The real return for the entire eight-year period was thus slightly negative. Since more than half of their repeat sales occurred in less than one year, the findings are especially bearish for speculation in paintings.

Papers employing time-series econometric methods have begun to appear in the literature on art economics. In an early effort to investigate the short-run predictability of art prices in the aggregate, Chanel [1995] explores whether financial markets are related to the art market. Employing causality tests and vector autoregression models he finds that major stock indices in New York, London, Paris, and Tokyo lead an art price index constructed from a hedonic regression model by about one year. He concludes that although art is subject to unpredictable long-run changes in tastes, in the short run changes in financial markets affect the art market in the aggregate. Ginsburgh and Jeanfils [1995] also find short-run links between financial and art markets especially with Japanese stock (Nikkei index) but no long-run relationships. This long-run independence allows them to analyze returns in isolation from the rest of the economy using cointegration techniques. They find that the New York, London, and Paris markets move together closely for three groups of painters from 1962 to 1991. Also the overall returns for the painting groups are similar and move together, but European Great Masters lead the lesser groups. A follow-up study by Flores,

Ginsburgh and Jeanfils [1999] investigate risk for various groupings and find that although returns are similar, well-known masters offer less short-run risk and are thus preferable.

Recently Galenson and Weinberg [2000] extend the economics literature on art in a somewhat different direction by investigating a shift in the demand for modern American paintings. This structural change seems to have occurred in the 1950s and 60s and has altered the relationships between artists' ages and the value of their paintings. For this group of modern American artists the age at which their most valuable works were produced has declined dramatically. For artists born between 1900 and 1920 the age/price relationship peaks arrived at age 50 whereas for artists born from 1921 to 1940 the peak occurs before age 30. Whether these measurements reflect a permanent shift in the career productivity/age profile or a bandwagon that this group of young artists rode remains to be see. The assessment of future art historians will determine also whether this new genre of contemporary American art represents the latest transitory shock or a permanent effect. The financial return for investments in this new genre is also uncertain.

METHODOLOGY

Market for Paintings

To analyze returns and risk to art purchases, and thus determine an opportunity cost to collecting in the arts, we must first compute price indices. Since art is not a homogenous commodity traded in highly organized markets like stocks and bonds, the construction of these price indices is a nontrivial matter. Due to special features including resalability and reputation, the art market has been characterized by a hierarchy of submarkets [Gerard-Varet, 1995]. The first stage, or primary market, involves the artist/producer selling at galleries, local exhibitions, or directly to consumers. This initial transaction level allows artists to signal their abilities to the secondary market, which is often dominated by a limited number of dealers who exhibit in galleries. Leading galleries will often attempt to gain monopsonistic power through exclusive contracts with promising artists. The dealer market is especially suited to matching specialized artworks to certain collectors [Goetzmann, 1993] with dealer returns reflecting this effort and any related expenses. The top of the hierarchy is an international market dominated by a few auction houses whose patrons are mostly individual wealthy collectors, museums, and foundations. Top works will likely eventually enter this tier with auction houses profiting by matching the very valuable works to the buyer group with high willingness and ability to pay.

Auctions are certainly the most visible market segment, and their volume appears to have expanded considerably in recent years. For the data used in this study, auction sales increase an average 7 percent annually from 1971 to 1996. From 1971 to 1989 the annual growth is fairly steady averaging over 10 percent. Since peaking in 1989, auction sales drop off sharply to late 1970s levels by 1991, and then recover sharply, reaching 1988 levels by 1996. Auction growth may in part be due to aggressive marketing by the various houses as well as fairly low transaction costs. By providing financing for buyers as well as guarantees for sellers, however, auction houses

have been known to do more than simply act as intermediaries. Commissions at the major houses are typically in the 10-20 percent range on both buyers and sellers, which, although higher than traditional financial markets, are low compared to the dealer market. Recently the auction houses Christie's and Sotheby's have pleaded guilty to price fixing primarily in their dealings with sellers. These charges raised by the U.S. Justice Department have resulted in fines totaling millions of dollars and have caused top executives to lose their jobs and reputations. Although a setback for the present, this antitrust case may enhance the auction tier of the art market in the long run if participants feel more confident that they will be treated fairly and honestly in the future by auction houses. The rise in auctioneering using the Internet will likely continue also as technology improves and costs continue to fall.

Data

Although auction records provide a large stream of generally reliable public information on painting transactions, they are not without potential difficulties. Goetzmann [1993] argues that auction markets, especially repeat-sale records, may fail to capture price fluctuations of low demand or out-of-fashion paintings. Auction houses have little incentive to sell works with low public interest and owners may hold back in times of falling values. In addition, if transactions include "bought in" works, prices may be inflated. It is clear that auction records alone do not reflect the entire market, but whether auction prices are biased upwards or downwards is less clear. Most early empirical studies of returns to painting purchases use some variant of repeat sales information from auction records to compute rates of return over time. Although having the advantage of controlling for characteristics intrinsic to the painting, repeat sales data have disadvantages. External factors such as characteristics surrounding the sale that may affect prices and returns are not generally controlled for. In addition, the sample of repeat sales is not only a small subset of the painting market but may be unrepresentative. It is not clear in what direction repeat sales may bias returns. On the one hand repeat sales may lose some potential benefits of provenance and reflect damaged goods, but on the other a truly inferior or damaged piece is unlikely to enter the highly visible international auction market more than once.

An alternative to the repeat sale methodology, which we have in our paper, is a hedonic model. In this framework sales of paintings over time are pooled together to simultaneously estimate returns as well as the effects of various characteristics of the painting or sale on price. Controlling for these characteristics is necessary since the paintings are quite heterogeneous. In addition to using all auction sales, the hedonic approach has an additional benefit in that shadow (implicit) marginal valuations are estimated, which are interesting in their own right since they provide information to buyers and sellers in the art market. The data used in this study are taken from auction transactions published in the *Annual Art Sales Index* [Hislop, 1971-1996] including only sold works (that is, no "bought ins"). The sample consists of 25,217 transactions of paintings by 91 American artists born before World War II whose works generally command high prices and/or are sufficiently large in number to exhibit high turnover frequency at auction. Tables 1 and 2 provide the information

TABLE 1
Variable Definitions

Variable	Definition	Mean	Std. Dev.
PRICE	Auction price in current U.S. dollars	53485	292890
LNPRICE	Natural logarithm of price	9.11	1.69
LOT	Order number for painting in auction divided by 1000	0.26	0.54
LOTSQ	Lot squared	0.36	2.17
ILUS	1 if illustration or description in auction catalog; 0 otherwise	0.83	0.38
SIGNED	1 if painting is signed; 0 otherwise	0.81	0.39
DATED	1 if painting is dated; 0 otherwise	0.44	0.50
OIL	1 if medium of painting is oil/acrylic on canvas, panel, board, Masonite, or metal; 0 otherwise (e.g. watercolor, gouache, ink, pencil, pastel, chalk, tempura, or charcoal)	0.50	0.50
SIZE	Area of painting in square inches divided by 1000	0.82	2.10
SIZESQ	Size squared	5.08	2.22
ALIVE	1 if the artist was alive when the auction was held; 0 otherwise	0.06	0.23
Auction House			
SPB	1 if Sotheby's New York; 0 otherwise	0.42	0.49
CHNY	1 if Christie's New York; 0 otherwise	0.25	0.43
Months			
JAN	1 if auction occurs within January; 0 otherwise	0.03	0.16
FEB	1 if auction occurs within February; 0 otherwise	0.06	0.24
MAR	1 if auction occurs within March; 0 otherwise	0.07	0.26
APR	1 if auction occurs within April; 0 otherwise	0.07	0.26
MAY	1 if auction occurs within May; 0 otherwise	0.22	0.42
JUN	1 if auction occurs within June; 0 otherwise	0.09	0.29
JUL	1 if auction occurs within July; 0 otherwise	0.02	0.12
AUG	1 if auction occurs within August; 0 otherwise	0.01	0.08
SEP	1 if auction occurs within September; 0 otherwise	0.05	0.22
OCT	1 if auction occurs within October; 0 otherwise	0.11	0.30
NOV	1 if auction occurs within November; 0 otherwise	0.16	0.37
DEC	1 if auction occurs within December; 0 otherwise	0.12	0.33

available from the auction records, and the list of artists with their specialties respectively.

The *American Art Analog*, [Zellman, 1986] and *Currier's Price Guide* [1991] were used to determine a set of U.S. artists whose paintings command high prices ($10,000 minimum). In addition, high trading volume (at least 3 works per year) was determined from the *American Art Analog,* which provides averages and the *Annual Art Sales Index,* which records actual transactions. The union of these sets provided the bulk of the sample used in this study with a few well-known exceptions of artists whose works are rarely observed at auction. These were excluded because they would have added little to our sample. A few artists remain in the sample who although well-known don't meet our price or volume criteria because of inconsistencies between the above art sources. In addition, some artists who do meet our criteria may

TABLE 2
Artists Included in the Sample

Artist Name	Year Born	Year Died[a]	Subject Matter
Joseph Albers	1888	1976	Avant-garde
Milton Avery	1885	1965	Avant-garde
George W. Bellows	1882	1925	Figures, Genre, Landscapes
Thomas Hart Benton	1889	1975	Figures, Genre, Illustrations, Landscapes
Albert Bierstadt	1830	1902	Landscapes, Marines
Ralph A. Blakelock	1847	1919	Landscapes
Carl O. Borg	1879	1947	Illustrations, Landscapes
Alfred Thompson Bricher	1837	1908	Figures, Genre, Landscapes, Marines
George Brown	1814	1889	Landscapes, Marines
John G. Brown	1831	1913	Genre
Charles Burchfield	1893	1967	Avant-garde, Landscapes
James E. Buttersworth	1817	1894	Marines
Alexander Calder	1898	1976	Avant-garde
Mary Cassatt	1844	1926	Figures
William M. Chase	1849	1916	Figures, Landscapes, Still Life
Frederic Church	1826	1900	Landscapes, Marines
Thomas Cole	1801	1848	Landscapes
Jasper F. Cropsey	1823	1900	Landscapes, Marines
William DeKooning	1904	—	Avant-garde
Richard Diebenkorn	1922	1993	Avant-garde
Jim Dine	1935	—	Avant-garde
Arthur Dove	1880	1946	Avant-garde, Illustrations, Marines
Harvey Dunn	1884	1952	Illustrations
Thomas Eakins	1844	1916	Figures, Genre, Marines
John J. Enneking	1841	1916	Landscapes
John F. Francis	1808	1886	Figures, Still Life
Sam Francis	1923	1994	Avant-garde
Helen Frankenhaler	1928	—	Avant-garde
Sanford R. Gifford	1823	1880	Landscapes
William James Glackens	1870	1938	Figures, Illustrations, Landscapes
Arshile Gorky	1904	1948	Avant-garde
Adolph Gottlieb	1903	1948	Avant-garde
Philip Guston	1913	1980	Avant-garde
Childe Hassam	1859	1935	Figures, Landscapes
Martin J. Heade	1819	1904	Figures, Landscapes, Still Life
Robert Henri	1865	1929	Figures, Genre,
Thomas Hill	1829	1908	Figures, Landscapes, Still Life
Hans Hofmann	1880	1966	Avant-garde
Winslow Homer	1836	1910	Figures, Genre, Illust.,Landscapes, Marines
Edward Hopper	1882	1967	Genre, Landscapes
George Inness	1825	1894	Landscapes
Antonio Jacobsen	1850	1921	Marines
Jasper Johns	1930	—	Avant-garde
Ellsworth Kelly	1923	—	Avant-garde, Figures
John F. Kensett	1818	1872	Landscapes, Marines
Franz Kline	1910	1962	Avant-garde
Daniel R. Knight	1839	1924	Figures, Genre
Fitz Hugh Lane	1804	1865	Landscapes, Marines
Ernest Lawson	1873	1939	Landscapes
Scott Leighton	1849	1898	Figures, Landscapes, Wildlife
Richard Hayley Lever	1876	1958	Landscapes, Marines

TABLE 2 (Cont.)
Artists Included in the Sample

Artist Name	Year Born	Year Died[a]	Subject Matter
Sol Lewitt	1928	—	Avant-garde
Roy Lichtenstein	1923	—	Avant-garde
George Luks	1867	1933	Figures, Genre, Landscapes
Ernest Major	1864	1950	Figures, Landscapes, Still Life
Man-Ray	1890	1976	Avant-garde
Reginald Marsh	1898	1954	Figures, Genre, Illustrations
Lazlo Moholy-Nagy	1895	1946	Avant-garde
Thomas Moran	1837	1926	Landscapes, Marines
Robert Motherwell	1915	1991	Avant-garde
William S. Mount	1807	1868	Figures, Genre, Landscapes, Still Life
George W. Nicholson	1832	1912	Figures, Landscapes
Kenneth Noland	1924	—	Avant-garde, Landscapes
Georgia O'Keefe	1887	1986	Avant-garde
Jules Olitski	1922	—	Avant-garde
Jules Pascin	1885	1930	Avant-garde, Figures
James Peale	1749	1831	Figures, Landscapes, Marines, Still Life
John F. Peto	1854	1907	Still Life
Jackson Pollock	1912	1956	Avant-garde
Edward H. Potthast	1857	1927	Figures, Genre, Landscapes
Maurice Prendergast	1861	1924	Avant-garde, Figures, Landscapes
Robert Rauschenberg	1925	—	Avant-garde
Frederick Remington	1861	1909	Figures, Genre
William T. Richards	1833	1905	Figures, Landscapes, Marines, Still Life
Larry Rivers	1923	—	Avant-garde
Norman Rockwell	1894	1978	Illustrations
James Rosenquist	1933	—	Avant-garde
Mark Rothko	1903	1970	Avant-garde
John Singer Sargent	1856	1925	Figures, Landscapes
Everett Shinn	1876	1953	Figures, Genre, Illustrations
Frank Stella	1936	—	Avant-garde
Joseph Stella	1877	1946	Figures, Landscapes, Still Life
Arthur F. Tait	1819	1905	Figures, Genre, Wildlife
Wayne Theibaud	1920	—	Avant-garde
John H. Twachtman	1853	1902	Landscapes
Cy Twombly	1929	—	Avant-garde
Andy Warhol	1930	1986	Avant-garde
Tom Wesselmann	1931	—	Avant-garde
James Abbott McNeil Whistler	1834	1903	Figures, Landscapes
Thomas W. Whittridge	1820	1910	Landscapes, Marines
Andrew Wyeth	1917	—	Figures, Landscapes, Wildlife

1 if work executed by named artist: 0 otherwise.
a. No date indicates that the artist was alive at the end of the period of analysis (1996).

be excluded due to oversight. Thus, the sample includes a wide variety of high volume artists with a bias towards the famous. The mean nominal price of the entire sample from 1971 to 1996 for 91 artists is $53,485 with a standard deviation of $292,890 and a range of $45 to $18,800,000.[1]

Model

In the hedonic model a regression for price (or log price) is estimated from data for works sold at various points of time. The hedonic model can be written as:

$$\text{Ln}\, P_{it} = \alpha_0 + \sum_{k=1}^{m} \alpha_k X_{k,it} + C(t) + e_i \tag{1}$$

where $\text{Ln}P_{it}$ is the natural logarithm of the price of painting i sold at time t ($t = 0.....T$); X_{ki} represents characteristics k ($k = 1....m$) either intrinsic to the painting (for example, size of the work) or elements surrounding the sale (for example, place or season of sale); $C(t)$ is a time varying market-wide effect; and e_i is a random error.

$C(t)$ can be defined for different purposes. Since we wish to compute annual price indices, we define $C(t)$ as:

$$C(t) = \sum_{t=1}^{T} B_t Z_t \tag{2}$$

where Z_t is a dummy variable equalling 1 if the work is sold in the time period and zero otherwise. The B's represent log price indices normalized to 0 for the base year 1971. Exp (B) thus reflects the actual price index and is equal to 1 for 1971. If one wishes to estimate a single average rate of return, $C(t)$ is simply proportional to t. In this less general case the time regression slope (B) or alternatively [exp(B)−1] can be interpreted as the implicit global rate of return over time [Agnello and Pierce, 1996; Chanel et al., 1996].

In the hedonic regression framework the X's allow for the effect of painting heterogeneity on price by controlling for the numerous differences among paintings. The log price indices (B) are thus characteristic-free, and can be used to construct price indices. The α_k represent implicit marginal values associated with characteristics. Since the dependent variable is log price, 100[exp(α)−1] reflects the percent change in price associated with the particular characteristic intrinsic to the painting or surrounding the sale. Generally recognized as the most important intrinsic factors determining price of paintings are the reputation of the artist, artistic merit, authenticity of the work, subject, size, and condition. Artistic merit is not easy to measure objectively and reflects numerous factors such as style and subject matter, period of life in which the work was painted, historical importance, construction medium, and conformity with the artist's typical works [Anderson, 1974; Currier, 1991]. The most common and perhaps most desirable medium is oil but a wide variety of other potentially valuable media exist including mixed media, watercolors, gouaches, pastels and drawings. Construction of the work is also distinguished by the support for the medium which may include backings other than canvas such as board and paper. In addition to intrinsic attributes of the painting, various outside influences can affect prices. These include history of ownership or provenance as well as elements surrounding the sale such as timing, location, publicity, commissions, and competition. For example, it has been argued that sales during summer months experience the lowest prices [Currier, 1991], while late spring and fall sales command both high prices and

much media attention. Selling art in a region related either to the artist or the subject matter of the work is generally considered to increase its value.

EMPIRICAL FINDINGS

Hedonic Values

The estimates rounded to three significant digits for equation (1) using the entire sample are found in Table 3. First we discuss the findings for the hedonic values for various characteristics and later focus on the price indices for the whole as well as disaggregated samples. The variables can be inferred readily from the definitions given in Table 1. SIZE and LOT, the only continuous right hand side variables in the regressions, show nonlinear effects on log price with their squares (*SIZESQ* and *LOTSQ*) being statistically significant. A larger size increases a painting's value, but at a diminishing rate since the square of size has a negative coefficient. The opposite is the case for lot number where we find that sales very late in an auction are associated with higher prices. In both cases the curvature, although significant, is weak.[2] Thus for the relevant size and lot ranges, the larger the work the greater the value, and the later in the auction the work is offered for sale the lower the value. These results agree with earlier studies of U.S. paintings [Agnello and Pierce, 1996; Beggs and Graddy, 1997].

The other variables in the regression are (0, 1) dummy variables. For these we compute [100(exp(a)−1], which is interpreted as the percent change in price associated with the change of the dummy variable from 0 to 1.[3] For paintings that are signed, dated, of oil medium, or are illustrated in auction catalogs, (taken from Table 3) the computation results in .278, .236, .997, .885 respectively. Evaluating 100(exp(a)21) we observe higher prices of 32 percent, 27 percent, 171 percent, and 142 percent respectively from the base category. The variables *SIGNED* and *DATED* are likely associated with higher values although these characteristics do not guarantee authenticity. Since masterpieces are typically executed in superior and difficult media, OIL acts as a proxy for quality and is associated with higher sale prices. Similarly, paintings illustrated in auction catalogs are often selected on the basis of quality as well. The variable Sotheby's New York (*SPB*) and Christie's New York (*CHNY*) increase price by 68 percent and 54 percent, respectively, over all other auction houses. Auction house also likely proxies quality since only the most valuable works are accepted for sale at the most famous auction houses. *ALIVE* is associated with a negative effect on price (21 percent). Although a significant control variable, the *ALIVE* effect is probably the result of the particular mix of artists and styles present in the sample and not necessarily indicative of price increases associated with the death effect. In our earlier study for fewer artists and years, we found a positive effect for live artists [Agnello and Pierce, 1996].[4]

The dummy variables reflecting month of sale generally serve as important regression controls.[5] February, September, and January (the base month) are associated with the lowest prices. Not surprisingly these months have fairly low sales volume observed from Table 1. July and August, the lowest volume months, however,

TABLE 3
Regression Estimates for Equation 1

Variable	Coefficient	Beta Coet	*t*- Statistic	P- Value
INTERCEPT	6.11	—	50.8	0.00
SIZE	0.300	.372	57.5	0.00
SIZESQR	−.001	.196	−36.1	0.00
LOT	−0.300	−.096	−10.8	0.00
LOTSQ	0.054	.069	8.15	0.00
SIGNED	0.278	.064	14.9	0.00
DATED	0.236	.054	13.6	0.00
OIL	0.997	.294	58.5	0.00
ALIVE	−0.194	.026	−4.49	0.00
ILUS	0.885	.199	34.6	0.00
SPB	0.520	.150	29.1	0.00
CHNY	0.433	.110	21.5	0.00
FEB	0.070	.010	1.42	0.16
MAR	0.241	.037	5.04	0.00
APR	0.502	.068	10.5	0.00
MAY	0.645	.104	14.6	0.00
JUN	0.361	.062	7.75	0.00
JUL	0.608	.043	9.08	0.00
AUG	0.534	.025	5.71	0.00
SEP	0.080	.010	1.61	0.11
OCT	0.316	.056	6.86	0.00
NOV	0.630	.138	14.0	0.00
DEC	0.718	.140	15.9	0.00
R^2=.64	F=330			*n*= 25,217

Coefficients for year and artist dummy variables are not reported.

are associated with fairly high prices contradicting the popular belief that these two months have lower prices [Currier, 1991]. The highest price months, May, November, and December, have average prices 91, 88, and 105 percent higher than January, the base month. These are also the highest volume months and reflect the traditional auction seasons.

The artist dummy variables serve as extremely important control variables in the regression. The R^2 rises from .48 to .64 with their inclusion resulting in a highly significant F (90, 25079) statistic of 124 for the group of artist dummy variables [Green, 2000]. The four most valued artists are Jasper Johns, Georgia O'Keefe, Fitz Hugh Lane, and Jackson Pollack whose works on average command prices, 1063, 623, 600, and 569 percent higher respectively, than the base artist Joseph Albers (percent computed as $100(\exp(\alpha)-1)$). At the other extreme we find Ernest Major, George Nicholson, George Brown, and Scott Leighton whose works command prices of 12, 13, 16, and 17 percent on average respectively of those of the base artist. Thus, the difference in price on average between a work by Ernest Major and one by Jasper Johns is reflected by an index range of 12 to 1163 or a relative factor of almost 100. Even among well-known artists there are indeed great differences when it comes to valuation.

TABLE 4
Yearly Price Indices for Categories Ordered by Performance

Year	Land-scape	Marine	Wild life	Low-end	Avant-garde	Figures	Over-all	Genre	Illus-trations	Still Life	High-end
1971	1.00	1.00	1.00	*1.00*	1.00	1.00	**1.00**	1.00	1.00	1.00	*1.00*
1972	1.25	0.94	0.96	*1.20*	1.52	1.83	**1.54**	1.12	1.23	2.67	*1.70*
1973	1.66	2.24	1.56	*1.51*	1.93	2.06	**2.13**	1.99	2.33	2.72	*2.31*
1974	1.60	1.36	0.91	*1.56*	2.19	2.17	**2.16**	2.15	2.17	2.34	*2.74*
1975	1.10	1.01	0.74	*1.22*	1.53	1.33	**1.60**	1.25	1.09	1.79	*3.05*
1976	1.19	1.01	1.06	*1.06*	1.12	1.28	**1.35**	2.57	3.22	2.05	*2.34*
1977	0.59	0.71	0.53	*0.77*	0.77	0.76	**0.94**	1.82	2.01	1.12	*2.88*
1978	0.56	0.62	0.52	*0.68*	0.53	0.65	**0.83**	0.77	1.03	1.65	*2.98*
1979	0.56	0.69	0.53	*0.82*	0.69	0.69	**1.02**	1.10	1.04	1.71	*3.82*
1980	0.82	0.96	0.66	*0.94*	0.72	0.92	**1.15**	1.39	1.27	1.96	*4.38*
1981	1.03	1.25	0.56	*1.16*	0.76	1.09	**1.49**	1.92	1.51	3.41	*5.45*
1982	0.92	1.08	0.61	*0.96*	0.69	0.95	**1.26**	1.69	1.33	2.72	*4.94*
1983	1.17	1.37	1.07	*1.12*	0.81	1.19	**1.52**	2.65	2.10	3.07	*5.45*
1984	1.00	1.08	0.75	*1.15*	0.87	1.11	**1.49**	2.00	2.24	3.33	*5.83*
1985	1.03	1.30	0.74	*1.15*	1.04	1.18	**1.55**	1.97	2.00	3.12	*6.35*
1986	1.05	1.22	1.01	*1.41*	1.32	1.33	**1.92**	2.06	1.82	3.68	*6.73*
1987	1.26	1.49	1.41	*1.80*	1.87	1.80	**2.56**	3.16	2.85	3.55	*8.66*
1988	1.52	1.77	1.34	*2.12*	3.04	2.29	**3.40**	3.75	3.58	3.51	*10.14*
1989	2.65	2.29	2.77	*2.75*	4.70	3.36	**4.93**	4.45	3.98	7.61	*13.16*
1990	1.67	1.88	1.98	*2.50*	3.76	2.40	**4.02**	2.79	3.31	5.97	*14.26*
1991	1.19	1.39	1.25	*1.79*	2.18	1.70	**2.66**	2.21	2.44	5.36	*10.30*
1992	1.13	1.26	1.16	*1.87*	2.35	1.41	**2.74**	2.45	2.24	3.48	*10.13*
1993	1.52	1.80	1.30	*1.75*	1.78	2.01	**2.49**	2.83	2.61	4.00	*9.32*
1994	1.50	1.57	0.69	*1.73*	2.10	1.84	**2.50**	2.89	3.41	3.64	10.21
1995	1.79	2.05	1.55	*1.87*	2.07	2.01	**2.76**	3.53	4.18	4.05	*9.74*
1996	1.66	1.80	1.85	*1.98*	2.00	2.30	**2.86**	3.25	3.41	4.67	*11.99*
Sample size[a]	9181	4307	484	*21234*	13070	9076	**25217**	3973	2216	1576	*3983*

Price indices computed as e^{Bt} from Table 3 where B_t are the coefficients associated with the Year (t). Since $B(1971)$ is normalized to 0, each price index for 1971 is 1.0. Definitions for categories by art style classification can be found in Currier (1991).

a. Sample for number of paintings included in the relevant regression using Equation (1).

Returns and Risk

The year dummy variable coefficients B_t are the basis for computing price indices, rates of return, and risk measures for paintings. Table 4 presents price indices based on the regression presented in Table 3 for the entire sample (that is, the "overall" column). In addition, disaggregated price indices based on equation (1) are presented for various stratifications of the data whose regressions are not reported. These reflect quality as well as subject matter data groupings.[6] Figures 1-3 show the price indices from Table 4. High and low end reflects quality differences using the sample real mean price indices as the partition. Generally, less than 20 percent of the sample is reflected by the high end due to the skewing of the data caused by some very expensive works. Subject matters were determined using Currier's [1991] eight classifications which include: avant-garde, figures, genre, illustrations, landscapes, marines,

FIGURE 1
Price Indices for Paintings

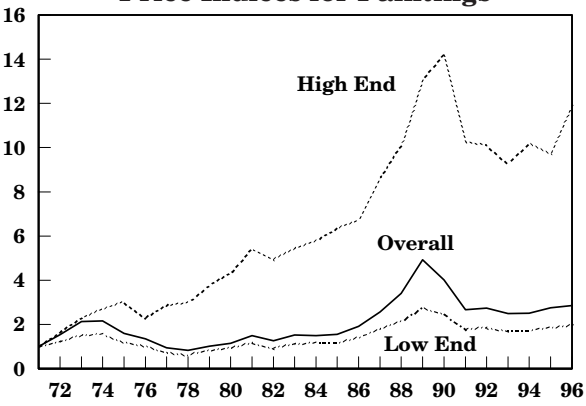


FIGURE 2
Price Indices by Subject Matter

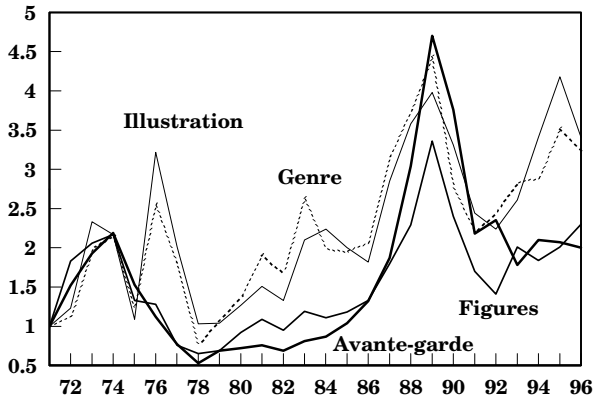
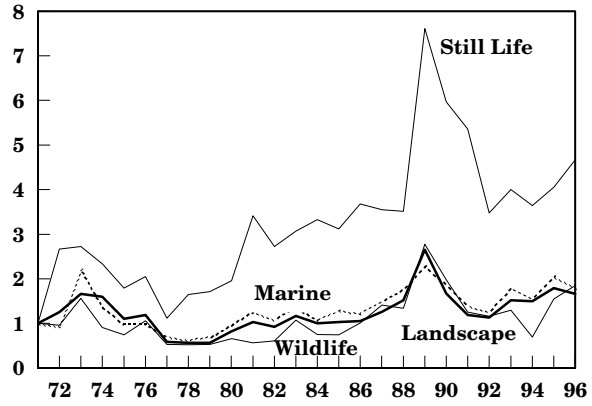


FIGURE 3
Price Indices by Subject Matter



still life, and wildlife. For example, avant-garde is defined as a "group active in the invention and application of new techniques in a given field, especially in the arts" and genre is described as a "category of artistic composition marked by a distinctive style, form, or content, especially a style of painting concerned with depicting scenes and subjects of common everyday life."

Figures 1-3 reveal several important findings. First, the growth in most price indices up to 1989 and a sharp decline and partial rebound afterwards is clear especially in Figure 1. This pattern is very similar to the findings of other recent studies mentioned earlier [Biey and Zanola, 1999; Pesando and Shum, 1999]. The results also support the Ginsburgh and Jeanfils [1995] findings of at least a short-run connection between art prices and the Japanese Nikkei stock index which also peaked in 1989. Indices by subject matter are somewhat noisier. They indicate the same general pattern, but also show a greater decline in the mid-1970s especially for the genre and illustration subject matters. The subject matter indices clearly move together although some perform better than others with still life outperforming the rest. The high- and low-end comparisons are perhaps the most striking. Figures 4-6 show these comparisons for three subject matters, avant-garde, figures, and genre where sample sizes are large enough to yield reliable results. Clearly the best price performance is associated with the high end of the market whether in general or by subject matter. For the entire sample the high end peaks later and recovers more strongly. High-end superior performance has always been the belief of most art experts. The results in this paper support this claim, and agree with our earlier study [Agnello and Pierce, 1996].

Table 5 reports annual rates of return (r) computed as log differences ($\ln P_t - \ln P_{t-1}$) directly from the regressions and risk (measured as standard deviation).[7] There is much variability in returns across categories. Overall we see that high-end works do much better, with average returns more than three times the returns of low-end works. This is also true in the analyses by subject matter where high-end average returns range from two to three times those of low-end works. In both the overall and subject matter analyses the higher return for high-end works is not accompanied by significantly higher risk as measured by the standard deviation. However, risk does increase substantially for individual subject matters. Standard deviations are generally higher for subject matters than the overall market by as much as two times.[8]

We now compare art returns and risk with those of the market benchmarks: U.S. stocks, bonds, and inflation measured respectively by the S&P 500 stock index (including dividend reinvestment), short-term government bills (6-month T-bills), long-term government bonds (maturity over 10 years *GOVLONG*), and the consumer price index (CPI). Figure 7 shows price indices for the painting categories overall, high end and low end from Figure 1, and also the CPI and S&P 500 indices. Clearly the S&P 500 index outperforms all others over the entire period. For the period up to 1991 however, the high-end painting index performs best, and for the whole period outperforms all benchmarks except the S&P 500. The overall and low-end painting indices are much poorer performers, and do not match inflation (measured by the CPI), thus resulting in a negative real return. The art market rise in the late 1980s did take the overall index above the CPI temporarily, but the decline after 1989 reversed this.

FIGURE 4
Price Indices for Avant-garde, High and Low

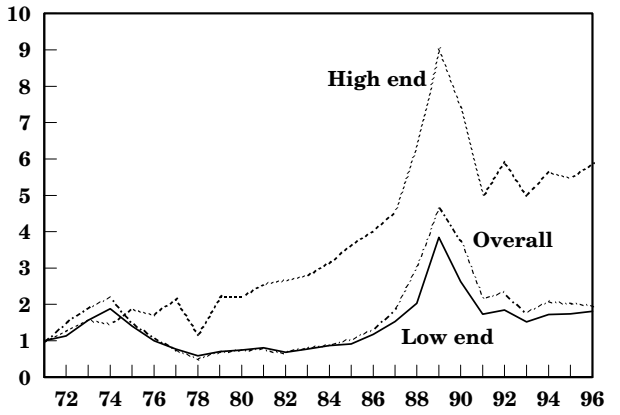


FIGURE 5
Price Indices for Figures, High and Low

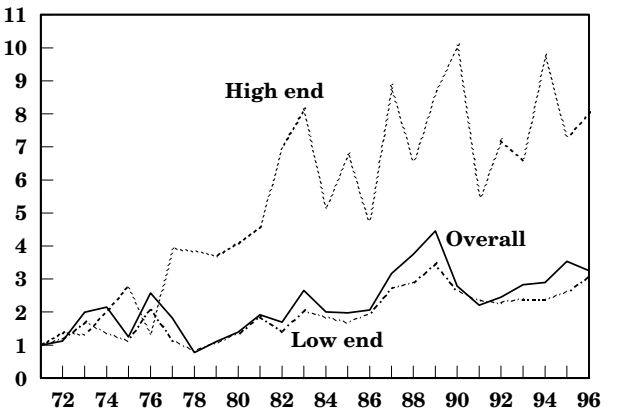


FIGURE 6
Price Indices for Genre, High and Low

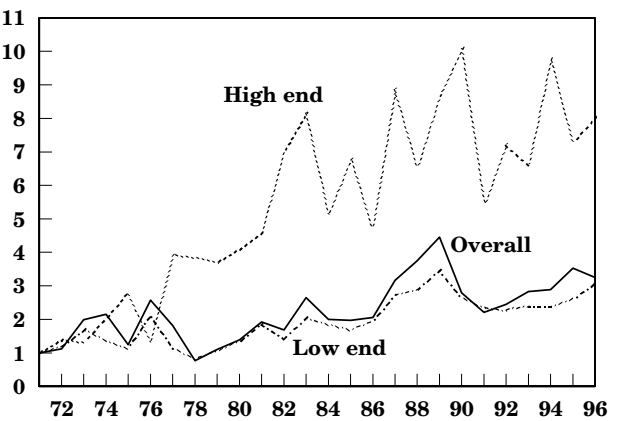


FIGURE 7
Price Index Comparison

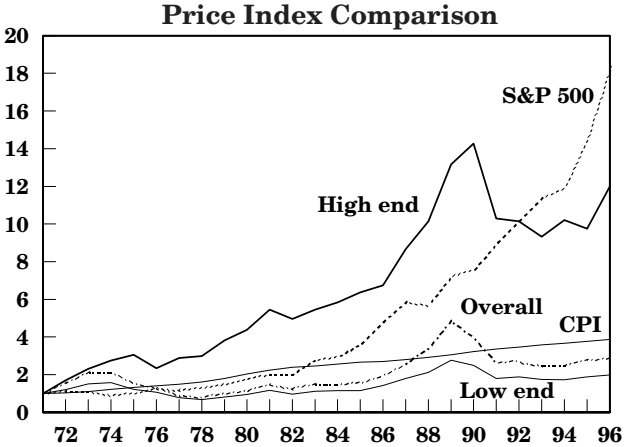


TABLE 5
Return and Risk Summary

Art Category	Return	Standard Deviation	PI (1996)[a]
Overall	0.042	0.231	2.86
High end	0.099	0.180	11.99
Low end	0.027	0.177	1.98
Avant-garde	0.028	0.285	2.00
High end	0.071	0.242	5.87
Low end	0.024	0.257	1.81
Figures	0.033	0.276	2.30
High end	0.073	0.258	6.20
Low end	0.020	0.184	1.63
Genre	0.047	0.362	3.25
High end	0.083	0.402	8.04
Low end	0.045	0.270	3.07
Illustration	0.049	0.388	3.41
Landscape	0.020	0.281	1.66
Marine	0.024	0.296	1.80
Still Life	0.062	0.344	4.67
Wildlife	0.025	0.401	1.85
Market Category			
S & P 500	0.116	0.121	18.31
CPI	0.054	0.030	3.88
GOVLONG[b]	0.085	0.020	NA
T-Bills	0.071	0.026	NA

a. Price indices are normalized to 1 in 1971. b. For long term government bonds and treasury bills, rates of return are computed as changes divided by previous level since level indices are unavailable.

TABLE 6
Return and Risk by Artist

Artist[a]	Return	Standard Deviation	PI (1996)[b]
Avery	.069	.264	5.65
Bierstadt	.003	.558	1.07
Bricher	.066	.352	5.24
Calder	.037	.268	2.55
Cassatt	.011	.804	1.33
Cropsy	.040	.481	2.74
DeKooning	.065	.695	5.10
Francis (Sam)	.074	.301	6.29
Hassam	.077	.442	6.86
Hofmann	.021	.305	1.70
Jacobsen	.069	.639	5.64
Lever	−.018	.531	0.64
Marsh	.060	.325	4.50
Moran	.045	.405	3.09
Noland	.017	.556	1.54
Pascin	.004	.237	1.11
Warhol	.054	.651	3.90
Wesselmann	.105	.484	13.9

a. Artist's full name is provided in Table 2.
b. Price indices are normalized to 1 in 1971.

From Table 5 we note that in all cases paintings are riskier than market alternatives especially for the highest return subject categories of illustration and still life. High returns do seem to be accompanied by high risk with the exception of the overall high-end category which is diversified over all subject categories. Our result that high-end paintings overall yield substantially higher returns with the same risk than low end differs somewhat from Flores, Ginsburgh, and Jeanfils [1999]. They find that returns are similar across their groupings but that the variance of returns is less for the Great Masters. Their conclusion of a preference for quality agrees with ours nevertheless. In our case returns are higher for quality; in their case risk is lower. When comparisons are made across subject matters, the results for returns are similar. High-end returns always exceed those of the low end. For risk, however, we find that investment in avant-garde high end to be no riskier than low end, but for figures and genre the high end is somewhat riskier than the low end.

Table 6 summarizes return and risk analysis for the highest volume artists included in the sample.[9] Since all initial price indices are normalized to 1 in 1971, the price index in 1996 reflects the value of an initial $1 investment twenty five years later. For only one artist, Richard Lever, would the investment have dwindled in value (to $0.64). For most artists the gain was modest, and for one artist, Tom Wesselmann, the investment would have appreciated to $13.90. Also very apparent is the low return/risk ratio associated with investment in individual artists. The ratio of return to standard deviation for artists and art categories is generally a small fraction of what we observe for the broad art and market categories shown in Table 5 indicating substantial benefits to diversification.

TABLE 7
Correlations in Returns

	Overall	High end	Low end	CPI	SP500	GOVLONG[a]	TBILL[a]
Overall	1.00	0.68	0.97	−0.08	0.23	0.07	0.20
High End	0.68	1.00	0.61	0.16	−0.10	−0.09	0.16
Low End	0.97	0.61	1.00	−0.03	0.26	0.13	0.25
CPI	−0.08	0.16	−0.03	1.00	−0.36	0.25	0.65
SP500	0.23	−0.10	0.26	−0.36	1.00	0.11	−0.09
GOVLONG	0.07	−0.09	0.13	0.25	0.11	1.00	0.83
TBILL	0.20	0.16	0.25	0.65	−0.09	0.83	1.00

a. These rates are computed as change over previous level since indices are not available. All other returns computed as log differences.

Although returns are found to be generally low and volatile, paintings may still provide a useful component to an investment portfolio if they serve to reduce overall risk. Paintings diversify a portfolio if their returns are negatively or at least not strongly correlated with returns of traditional financial assets. Table 7 presents correlations of annual return for the painting categories overall, high end and low end as well as some alternatives. The correlations between painting returns and the market alternatives are low, which agrees with Pesando's findings [1993, 1999], but contrasts with those of Goetzmann [1993]. For the high-end category, the returns are negatively correlated with stocks and long-term bonds. Although not reported in detail the correlation results are not affected much by the precise measurement of returns as log differences or change over previous level.

CONCLUSIONS

Using a large data set with a general hedonic price model we find the overall nominal investment return for the U.S. paintings in our sample from 1971 to 1996, which includes a variety of market swings, to be 4.2 percent per annum. This return lags behind the S&P 500 (11.6 percent), long- and short-term government bonds (8.5 percent and 7.1 percent respectively), and even below inflation (5.4 percent). We also find risk (measured by standard deviation) to be substantially higher for paintings. Thus the overall consumption costs associated with U.S. paintings is quite substantial making their purchase for pure investment unattractive in general. In addition it should be remembered that buying and selling costs associated with the auction sale of paintings are generally higher than transaction costs found in financial markets. The pessimistic conclusion changes somewhat when the findings are disaggregated however. If the purchaser is knowledgeable, lucky, and can afford to buy the best quality (high-end works), painting values can do much better than merely holding their real value. Paintings at the very high end of the price spectrum yield a nominal return of 9.9 percent per year which exceeds all the benchmarks except the S&P 500. This result supports the Singer and Lynch [1997] finding of little or no consumption cost in terms of return for "superstar" art. We do find higher risk for art investment in general especially when not diversified as shown by subject category and individual

artist results. However, the risk to our high-end superstar group is no higher than other groupings. The findings support the old maxim, "buy the very best that you can afford," so long as you can afford to buy the very best.

NOTES

A preliminary version of this paper was presented at the Tenth International Conference on Cultural Economics, Barcelona, June 1998. I wish to thank Rene Pierce for her able work in both data collection and computer assistance and also the editor and an anonymous referee of this Journal for useful comments and suggestions.

1. This large range in the price distribution for paintings suggests that the data may be highly skewed by a few very expensive paintings. The 99 percent range divided by the standard deviation for a standard normal distribution is roughly 6. The value of this ratio for our data is around 64 suggesting non-normality. Using log price helps to normalize the data by yielding a ratio for range to standard deviation of between 7 and 8 for our data.
2. Alternatively curvature can be achieved without the loss of one degree of freedom by logging the size and lot variables. Given the large sample we prefer generalized squares so that price maximums and minimums can be computed. By differentiating, the price maximizing size is found to be 1426 square feet which is beyond the sample maximum size of 1296 square feet. For lot number the price minimum is 5600 which is less than the sample maximum lot number of 9196 although beyond the 99th percentile for lot number which ends at 3067. A lull in action in the middle of the auction has been termed the "afternoon effect." In practice lot ordering may reflect an auctioneer's effort to keep up buyers' interest. Lot number may thus reflect a complex endogenous factor that proxies many things including quality of the item and also synergisms among groups of items. Unfortunately most auction data while revealing some information about individual items, do not provide much information about the whole auction.
3. Using the regression coefficient directly as the effect on price due to a characteristic change is not appropriate when the characteristic is a dummy variable and thus noncontinuous [Halvorsen and Palmquist, 1980]. The same adjustment is also necessary when interpreting the additive artist effects.
4. Ideally one would like to measure rarity directly, and also differentiate its effect for *ALIVE* versus deceased artists. Since artists still alive can devalue their works by increasing production, one would expect measured rarity to have less effect for them. Ekelund et al. [2000] have indeed observed a rise in values around the time of death for a sample of Latin American artists. Unfortunately our data do not allow for a determination of the separate or unique works sampled for an artist and thus a measurement for rarity.
5. If the best works are auctioned only during the "auction seasons" for reasons perhaps having to do with institutional or marketing factors, the monthly dummy variables are not strictly exogenous. As mentioned earlier this potential endogeneity also applies to the lot number, illustration, and auction house variables. A fully specified model, which unfortunately exceeds the identifying capability of the data, would reflect these simultaneities, and thus provide consistent estimates for the parameters of right hand side endogenous variables. Since our main objective is to compute temporal returns through the time dummy variable coefficients, we choose to retain these not strictly exogenous factors so as not to bias the estimates for temporal effects and the equation standard errors [Green, 2000].
6. Classifying over 25,000 paintings by subject matter is a time-consuming task since the auction records do not explicitly provide the subject matter of the work. The title is generally given, but without visually inspecting the work, even the title may not be definitive in identifying subject matter. Works for artists known for only one subject matter can be definitely classified since the auction records invariably indicate artist. Unfortunately this procedure results in small samples for certain subject matters since few artists are known exclusively for single subjects. Alternatively we may classify a painting as a particular style or subject if the artist was known for that subject but possibly not exclusively for that subject. Although this procedure does not characterize a painting with certainty, it yields samples of acceptable size, and was the basis for the results by subject matter. Since this

procedure may result in a work falling into more than one category, the sum of the sample sizes for all the subjects exceeds the total sample of 25,217.

7. Rates of return can be computed in a variety of ways and are generally approximately the same. However when rates are high, volatile, and sometimes negative as is the case of our painting categories, the asymmetry between positive and negative returns can greatly effect the non log algorithms. Using the change over previous price level algorithm generates substantially higher average returns than the log difference for all painting groups. The log difference algorithm can be viewed as a long-run holding return whereas the change over level can be viewed as a return from an annual buy/sell or speculative approach. For example, the overall average annual return is 4.2 percent using log differences and 6.9 percent for the nonlog calculation. The relatively stable CPI has a return of 5.4 percent to 5.6 percent for the two algorithms respectively. Since CPI does indeed finish higher in 1996 than paintings overall (seen in Figure 7), it can be very misleading to not use log differences. In the investment community the fine print should indicate the return algorithm as well as the usual disclaimer for future returns not being guaranteed.
8. As can be seen readily in Table 5 and later in Table 6 average rates of return are not significantly different from zero (at the .05 level) with the exception of the overall high-end category using the standard t-test for a sample mean (t = average return/sample standard deviation/$\sqrt{n}$, where $n = 25$). It follows also that rates of return are not significantly different from each other due to the high standard deviations. This shortcoming is a result of our empirical framework where global rates of return are derived from price indices for 26 years which come from the large sample hedonic regressions. It is likely that global returns (that is, averages) would be more precise if estimated directly in the large sample hedonic regressions, but with a loss of information on annual variation. For an illustration of this framework see Agnello and Pierce [1996].
9. Returns by artist were obtained from Equation (1) estimated for each artist in the sample. For many of the artists, the sample size was too small to estimate the year coefficients in the regression reliably. The artists included in the Table 6 reflect samples of over 300 and resulted in nonsingular (or non-near singular) data covariance matrices and thus more reliable results.

REFERENCES

Agnello, R. and Pierce, R. Financial Returns, Price Determinants, and Genre Effects in American Art Investment. *Journal of Cultural Economics,* 1996*,* 359-83.

Anderson, R. Paintings as an Investment. *Economic Inquiry,* March 1974, 13-26.

Beggs, A. and Graddy, K. Declining Values and the Afternoon Effect: Evidence from Art Auctions. *The Rand Journal of Economics*, Autumn 1997, 544-65.

Bianchi, M. Collecting as a Paradigm of Consumption. *Journal of Cultural Economics*, 1997, 275-89.

Biey, M. and Zanola, R. Investment in Paintings: A Short-Run Price Index. *Journal of Cultural Economics*, August 1999, 211-22.

Burton, B. and Jacobsen, F. Measuring Returns on Investments in Collectibles. *Journal of Economics Perspectives*, Fall 1999, 193-12.

Chanel, O. Is Art Market Behavior Predictable? *European Economic Review,* 1995, 519-27.

Chanel, O., Gerard-Varet, L., and Ginsburgh, V. The Relevance of Hedonic Price Indices: the Case of Paintings. *Journal of Cultural Economics,* 1996*,* 1-24.

Currier, W. *Currier's Price Guide to American Artists* (1645-1945) *at Auction*. Brockton, MA: Currier Publications, 1991.

Ekelund, R., Ressler, R., and Watson, K. The Death-Effect in Art Prices: A Demand-Side Exploration. *Journal of Cultural Economics*, November 2000, 283-300.

Flores, R., Ginsburgh, V., and Jeanfils, P. Long-and Short-Term Portfolio Choices of Paintings. *Journal of Cultural Economics*, August 1999, 193-210.

Frank, R. *Luxury Fever*. New York: The Free Press, 1999.

Frey, B. Art Markets and Economics: Introduction. *Journal of Cultural Economics,* 1997, 165-73.

_____. Superstar Museums: An Economic Analysis. *Journal of Cultural Economics,* 1998, 113-25.

Frey, B. and Eichenberger, R. On the Rate of Return in the Art Market: Survey and Evaluation. *European Economic Review,* 1995*,* 528-37.

Frey, B. and Pommerehne, W. Is Art Such a Good Investment? *The Public Interest*, 1988, 79-86.

Galenson, D. and Weinberg, B. Age and the Quality of Work: The Case of Modern American Painters. *Journal of Political Economy*, August 2000, 761-77.

Gerard-Varet, L. On Pricing the Priceless: Comments on the Economics of the Visual Art Market. *European Economic Review*, 1995, 509-18.

Ginsburg, V. and Jeanfils, P. Long-Run Comovements in International Markets for Paintings. *European Economic Review*, 1995, 538-48.

Goetzmann, W. Accounting for Taste: Art and the Financial Markets Over Three Centuries. *American Economic Review*, December 1993, 1370-76.

Green, W. *Econometric Analysis,* 4th ed. Upper Saddle River, NJ: Prentice Hall, 2000.

Halvorsen, R. and Palmquist, R. The Interpretation of Dummy Variables in Semilogarithmic Equations. *American Economic Review*, June 1980, 474-75.

Hirsch, F. *Social Limits to Growth*. Cambridge, MA: Harvard University Press, 1976.

Hislop, R., ed. *The Annual Art Sales Index.* Surrey, England: Art Sales Index LTD, 1971-1996.

http://bos.business.unab.edu. Internet address, 1998.

Koford, K. and Tschoegl, A. The Market Value of Rarity. *Journal of Economic Behavior & Organization*, 1998, 445-57.

Pesando, J. Art as an Investment: The Market for Modern Prints. *American Economic Review*, December 1993, 1075-89.

Pesando, J. and Shum, P. The Returns to Picasso's Prints and to Traditional Financial Assets, 1977 to 1996. *Journal of Cultural Economics*, August 1999, 183-92.

Singer, L. and Lynch, G. Are Multiple Art Markets Rational? *Journal of Cultural Economics,* 1997, 197-218.

Viner, J. The Utility Concept in Value Theory and Its Critics, in Utility Theory: A Book of Readings, edited by Alfred Page. New York: Wiley and Sons, (1925) 1968, 123-38.

Zellman, M. *The American Art Analog.* New York: Chelsea House, 1986.