A Note on Financial Risk, Return and Asset Pricing in Australian Modern and Contemporary Art

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A Note on Financial Risk, Return and Asset Pricing in Australian Modern and Contemporary Art[*]

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Abstract. In this note, 30,227 paintings by fifty well-known modern and contemporary Australian artists sold at auction over the period 1973-2003 are used to construct a hedonic price index. The attributes included in the hedonic regression model include the name, age and living status of the artist, the number of works sold, the size and medium of the painting, and the auction house, month and year in which the painting was sold. The results indicate that returns on Australian modern and contemporary art averaged nearly five percent over the period with a standard deviation of sixteen percent. The results also show that a ten percent increase in the Australian stock market is associated with a 3.4 percent increase in the art market. Generally, artworks by artists deceased at the time of auction, larger works, works executed in oils, and those auctioned by Sotheby's or Christie's in July or August are associated with higher prices.

Key words: risk and return, asset pricing, art investment

1. Introduction

There is burgeoning interest in the work of Australian artists. In 2004 a painting of Sydney Harbour by Brett Whiteley set a $2 million record price for modern Australian art and an explosive atmospheric painting by contemporary artist Tim Storrier sold for a personal best of $165,000 (Ingram 2003). Surging interest in Aboriginal art is also evident, particularly in works by Rover Thomas and Clifford (Possum) Tjapaltjarri. As a consequence, fine-art auction houses in Australia are struggling to keep up with the increased demand for Australian paintings. They are expected to set a new sales record of $100 million in 2004, up from $92 million in 2003, and more than four times the turnover generated a decade earlier (Maslen 2004).

One patently useful source of information for collectors, investors, galleries, auction houses and museums interested in Australian art is an art index. Unfortunately, and in sharp contrast to many other artistic collections, there is no known price index of modern Australian work, let alone Australian art more generally. This is a clear omission in the economics of art literature: Buelens and Ginsburgh (1993) calculated price indices for works by English, Dutch

and Italian painters, Agnello and Pierce (1996) created an index of price movements of leading American artists, Pesando and Shum (1999) used French auction prices to construct a price index, while Mok et al. (1993), Candela and Scorcu (1997) and Rennboog and Van Houtte (2002) produced price indices for Chinese, Italian and Belgian artistic works, respectively.

The limited purpose of this note is to fill this gap in the literature by investigating the financial risk, returns and asset pricing for modern and contemporary Australian works sold at Australian auction houses by creating an art market index. This is novel as the first step in developing an economic understanding of the Australian art market. It is also useful for the purposes of comparison with existing art market research, especially in those markets with a similar cultural ancestry and market structure, such as the United Kingdom and the United States. The paper itself is organised as follows. Section 2 outlines the empirical methodology to be used in the analysis. Section 3 provides a description of the data employed. The empirical results are dealt with in Section 4. The paper ends with some brief concluding remarks.

2. Empirical Methodology

Three principal methods have been used for calculating and analysing art returns: (i) the naïve (or arithmetic) art index method (Art Market Research 2004; Worthington and Higgs 2003; Worthington and Higgs 2004); (ii) the repeat-sales index method (Anderson 1974; Goetzmann 1993; Chanel et al. 1994; Gerard-Varet 1995; Mei and Mosses 2001); and (iii) the hedonic price index method (Buelens and Ginsburgh 1993; de la Barre *et al.* 1994; Chanel 1995; Agnello and Pierce 1996; Czujack 1997). The approach selected for the current analysis is the hedonic price index method. Assuming the availability of comprehensive data, the hedonic price index method's strengths are that it estimates values based on actual auction sales, and as a collateral outcome, captures the willingness to pay for perceived differences in the attributes of the artwork included in the index. The hedonic price equation is written as:

$$\ln p_{kt} = \sum_{m=1}^{M} \alpha_m X_{mkt} + \sum_{t=1}^{T} \beta_t Z_t + \varepsilon_{kt} \tag{1}$$

where $\ln p_{kt}$ is the natural logarithm of the price of painting k ($k = 1,...,K$) sold in year t ($t = 1,...,T$), X_{mkt} is the measurable characteristics m ($m = 1,...,M$) of painting k at time t, α_m are parameter estimates of the implicit prices of the specified art characteristics, Z_t is a dummy variable which takes the value of one for a sale occurring in year t and zero

elsewhere, β_t are parameter estimates of these yearly dummy variables, the error term $\varepsilon \sim N(0, \Sigma_k \otimes I_T)$ and $e^{\beta t}$ gives the art price index.

The data used comprises 30,227 sales transactions of artworks by fifty leading modern and contemporary Australian artists. Information on sales is obtained from Australian Art Auction Records (2003) and spans the period March 1973 to June 2003. The selection of artists to be included in the index is, of course, highly subjective and was arrived at after discussion with art auctioneers, curators and dealers on those artistic works most sought after and frequently sold at auction in the past thirty years. The dependent variable is the price of each artwork net of commission. Each artwork is sold exclusively at public auction houses in Australia and its value specified in nominal Australian dollars. Selected descriptive statistics of artwork prices by artist, medium and auction house are provided in Table I. Three sets of variables are considered to be determinants of the price of an individual artwork and are specified as explanatory variables. The first set of explanatory variables relate to the characteristics of the artist who painted the work. The second set corresponds to the physical characteristics of the work itself. The final set includes the sale characteristics of the work.

The first variable included in the set of artist characteristics is the name of the artist who created the work. It is well-recognised that one of the most important intrinsic factors determining the price of a painting is the reputation and quality of the artist. In addition, other factors thought to determine prices are closely related to the artist's name including style, subject matter and historical importance. Dummy variables are used to link each artist with their sold work. A listing of the artists, their year of birth and death (if applicable) and the number of works included in the sample are in Table I.

A second artist characteristic included represents the living status of the artist, taking the form of a dummy variable with a value of one if the painter is deceased at the time of the auction (*DTH*) and zero otherwise (Agnello and Pierce 1996). All other things being equal, the price of artworks are likely to increase once an artist has died such that the sign on the coefficient is expected to be positive. Six additional variables are included to reflect other dimensions of the artist's work throughout their career. Four are the artist's age at the time of sale (*AGE*), age squared (*AGS*), age cubed (*AG3*) and age to the fourth power (*AG4*) representing the polynomial component. It is hypothesised that the value of works partly depends on when in an artist's life a work was sold. For example, works sold in the early formative years may not yield as much value as those when artistic technique and style has developed and stabilised: positive and negative coefficients are hypothesised when price is

regressed against *AGE*, *AGS*, *AG3* and *AG4* (Galenson and Weinberg 2000; Edwards 2004). The next two variables indicate the number of works sold in each calendar year; namely, works sold (*WSY*) as the linear part and squared works sold (*WSQ*) as the nonlinear part. With the law of demand, an increasing quantity of works in the market period should be associated with lower prices. A positive coefficient is hypothesised when price is regressed against works sold and a negative coefficient when regressed against squared works sold.

The second set of variables represents the physical characteristics of the artwork. The first four are dummy variables identifying the medium: namely, acrylic (*ACR*), the heavy, opaque watercolour paint known as gouache (*GOU*), oil (*OIL*) and watercolour (*WCO*). The reference category is all other mediums. The next two are the dimensions of the painted work as represented by surface area (*ARE*) in square metres (m^2) and surface area squared (*ASQ*) as the non-linear component. A positive relationship is generally hypothesised when price is regressed against *ARE,* although it is difficult for all but the largest public galleries to display very large works. On this basis, the expected sign on the coefficient for *ASQ* is thought to be negative (Agnello and Pierce 1996).

The final set of explanatory variables incorporate the sale characteristics of the works. While not only providing the basis for the art index, these variables also help control for price variations that may arise due to the timing and location of the sale. The first of these are dummy variables identifying in which of the three major Australian auction houses the sale took place: that is, either branches of international auction houses Christies (*CHR*) and Sotheby's (*SOT*) or Australian-based Deutscher-Menzies (*DEU*). The reference category is all other auction houses. In the absence of transaction costs, the law of one price dictates that no significant price difference should exist for paintings of similar quality. However, Pesando (1993), de la Barre *et al.* (1994) and Renneboog and Van Houtte (2002), amongst others, have found that Christies and Sotheby's systematically obtain higher hammer prices, chiefly because of reputation and market power.

The next sales characteristics identify the month and year when the work is sold. In Australia, the most highly-valued sales are often conducted in July (*JUL*) and August (*AUG*), though major sales are held throughout the year. Agnello and Pierce (1996: 368) also included month of auction in a study of the US auction market, concluding that "January, the base month, results in the lowest auction prices, while December, May and August experience relatively higher prices…although July and August are low volume months". Eleven dummy variables identify the month of auction with January as the reference category. Additional

dummy variables representing the years 1973-2003 are used to construct the price index itself: 1973 is the base period.

4. Empirical Results

The estimated coefficients, standard errors and *p*-values of the hedonic pricing regression model are presented in Table II. Because the null hypothesis of no heteroskedasticity in the least squares residuals was initially rejected, the standard errors and *p*-values incorporate White's corrections for an unknown form of heteroskedasticity. To test for multicollinearity, variance inflation factors are calculated (not shown). As a rule of thumb, a factor significantly greater than ten indicates the presence of harmful collinearity, but none of the explanatory variables exceeded this critical value. This suggests that multicollinearity, while present, is not too serious a problem.

Turning first to the artist characteristics, significantly higher values are placed on the works by Russell Drysdale (*DRY*), Brett Whiteley (*WHI*), Rosalie Gascoigne (*GAS*) and Rover Thomas (*THO*) and are associated with percentage price increases of 364.58, 390.23, 416.21 and 492.05 percent over the standard painting, respectively (not shown). A deceased artist at the time of auction (*DTH*) is associated with a price increase of 100.58 percent. By way of comparison, Agnello and Pierce (1996: 368) found a 154 percent increase in the auction prices of American art when the artist was still alive, justifying this paradoxical outcome as follows: "…since all of the live artists are contemporary, this effect may have more to do with style than the artist's being alive".

Of the remaining artist characteristics, age (*AGE*) is positive and significant, age squared and works squared (*AGS* and *WSQ*) are both negative and significant, though *WSQ* is small in magnitude, and works sold (*WSY*) is significant and positive. The estimated coefficients of *AG3* and *AG4* are respectively positive and negative and significant, though both are very small. Overwhelmingly (and not unexpectedly), there is clear evidence that the artist who completed the auctioned work has a strong influence on price with a redundant variables test of the null hypothesis that the artist characteristics are jointly insignificant rejected at any level (*F*-statistic = 198.80, *p*-value = 0.0000).

The physical characteristics in the regression model comprise the medium of execution and the size of the work. To start with, and as hypothesised, the percentage changes in value indicate that works executed in oil (*OIL*) command higher prices, with increases over the standard work (including charcoal, crayon, etchings, pastels and pencils) of 450.41 percent.

Unfortunately, it is difficult to compare these findings as other studies are sometimes limited to periods or movements when fewer media are known [see, for instance, de la Barre et al. (1994) and Renneboog and Van Houtte (2002)] or intentionally limited to a single medium [see Candela and Scorcu (1997) and Pesando and Shum (1999)]. Nevertheless, Agnello and Pierce (1996) found a 156 percent increase in prices for US oil works as compared to all other media (including watercolour, gouache, ink, pencil, pastel, etc.).

The remaining physical characteristics included in the regression model concern the size of the work. These are the area of the work in square metres (*ARE*) and its nonlinear component, area squared (*ASQ*). The positive sign of the area coefficient (1.1760) and the negative sign of its squared term (-0.0866) indicate that Australian modern and contemporary art prices first tend to increase with size, then decrease as the paintings become too large and difficult to house. The price-maximising size for works by the fifty Australian artists is 6.79 square metres. By comparison, Agnello and Pierce (1996) found the price-maximising size for American artists' work to be 6.53 square metres. A redundant variables test of the null hypothesis of the joint insignificance of the characteristics of the work (including medium and size) is rejected at the .01 level (*F*-statistic = 1314.22, *p*-value = 0.0000).

The sales characteristics show that auctions at Sotheby's (*SOT*), Christies (*CHR*) and Deutscher-Menzies (*DEU*) increase the standard price by 235.80, 230.14 and 203.51 percent, respectively, over all other auction houses. Pesando (1993), de la Barre et al. (1994), Agnello and Pierce (1996) and Renneboog and Van Houtte (2002) also found that "…Sotherby's typically fetches higher prices than Christies, while both experience higher prices than all other houses" (Agnello and Pierce 1996: 366).

However, care should be taken in interpreting these differences as a violation of the law of one price. As an example, both Sotheby's and Christies often attract more high valued artistic works and therefore some degree of simultaneity may exist between art price and auction house. Even among works by a single artist, those with anticipated higher values may be directed to the leading auction houses, with lesser work appearing in other venues, including galleries and private dealers. De la Barre et al (1994: 165) also concluded that "…the quality of a painting, not captured by our characteristics is partly picked up by the saleroom coefficients: a 'good' Picasso would go to Christies or Sotheby's New York, a less good one would be sold at Drouot's [a Paris-based auction house]…it is impossible to disentangle the two effects".

Other than the estimated coefficients for the years (which form the basis of the index series) the remaining sales characteristics represent the month of sale (with January as the reference

category). As hypothesised, art values are higher in the major sale months of July and August and lowest in the holiday season of December and January. This is similar to the results obtained by Agnello and Pierce (1996) in their analysis of the US auction market.

Table III provides the calculated Australian art index and index returns. As a means of direct comparison with Australian financial assets, the All Ordinaries stock price index and stock returns are also included. The All Ordinaries is a market value-weighted price index accounting for some ninety percent of Australian stock market capitalisation. In terms of returns, the arithmetic mean return for the art index over the sampled period is 4.82 percent as compared to an average stock return of 7.00 percent, and in line with the central predictions of capital asset pricing, the returns on art appear less risky than the stock market with a standard deviation of 15.63 percent compared to 16.06 percent. On this basis, it would appear that the market has performed at a similar level to other national markets. Renneboog and Van Houtte (2002), for example, found Belgian nominal average returns of 8.4 percent over the period 1970-1989 with a standard deviation of 19.4 percent, Agnello and Pierce (1996) estimated that the returns on American artists averaged 9.3 percent from 1971-1992, and Mei and Moses (2001) calculated average returns of 5.3 percent with a standard deviation of 9.3 percent, also on American auctions, though over the period 1950-1999.

The pattern of Australian art market returns over the sample period is also generally comparable to other studies in this area. Locatelli Biey and Zanola (1999: 220), for example, observed: "…from 1987 to the first semester 1992, investment in arts performed well if compared with alternative forms of investment, such as US stocks, US 30 year government bonds and gold. By contrast, from the second semester of 1992 to 1995 returns on painting were lower". Similarly, De la Barre et al. (1994) concluded that the nominal returns from Great Masters from 1962 to 1991 peaked in 1990, while Candela and Scorcu (1997: 190) discerned a "…weak negative correlation between the art market and the other markets emerges, a result that is reversed in the second half of the period [1983-1988]".

At first impression there appears to be some correlation between the Australian stock and art markets. A final requirement is then to examine this hypothesised causal relationship. As a means of avoiding spurious regression results, the well-known augmented Dickey-Fuller unit root tests of the null hypothesis of nonstationarity are conducted. The t-statistics reject the null hypotheses of a unit root for both the art (t-statistic = -3.9424, p-value = 0.0051) and stock (t-statistic = -5.2989, p-value = 0.0002) markets, indicating that both series are stationary. Since cointegration techniques are not required, a least squares regression is specified with art and stock returns as the respective dependent and independent variables.

The estimated coefficient on stock returns is positive and significant at the .10 level and indicates that a 10.0 percent increase in stock returns is associated with a 3.40 percent increase in art returns. A Chow breakpoint test is conducted to test whether there has been a change in the functional relationship between stock and art markets in the period before 1990, between 1990 and 1992, and the period after 1992. This corresponds to the art market downturn of the early 1990s and the wide disparity between stock and art returns during the stock bull market of the 1990s. The test (F-statistic = 2.6014, p-value = 0.0614) rejects the null hypothesis of no change and we may conclude that the causal relationship between the Australian stock and art markets has modified over time. One possibility is that the individual and corporate wealth earned in equity markets, and sometimes ploughed into non-financial assets such as art, was instead reinvested in the booming equity market of the 1990s.

5. Concluding Remarks

This paper investigates risk and return in the Australia art market during the period 1973 to 2003. The hedonic price method is used to construct a yearly price index using data on 30,227 paintings by fifty well-known modern and contemporary artists sold at auction during this time. The results indicate that the returns on Australian art are about two percent less than those on Australian stocks over this period, though the risks are quite similar. A causal relationship is also found between returns in the stock market and those in the art market. However, since this relationship is not exact, the opportunity remains for diversification benefits from combining financial and non-financial assets in the same portfolio. The methodology employed in the paper also identifies factors associated with higher prices in the Australian art market. All other things being equal, works by artists deceased at the time of auction, larger sized works and those executed in oils, and those auctioned by Sotheby's or Christies in July and August are associated with higher prices.

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Table I. Selected descriptive statistics of artwork prices by artist, medium and auction house

Description	Variable	Born	Died	Works sold	Mean	Standard deviation
Arkley, Howard	ARK	1951	1999	87	$23,126	$45,798
Bernaldo, Allan	BER	1900	1988	431	$2,279	$2,266
Blackman, Charles	BLA	1928	–	2361	$8,006	$20,495
Booth, Peter	BOO	1940	–	119	$6,248	$15,966
Boyd, Arthur	BYA	1920	1999	1797	$20,426	$57,305
Boyd, David	BYD	1924	–	1645	$2,693	$2,772
Boyd, Jamie	BYJ	1948	–	178	$796	$872
Brack, Cecil John	BRA	1920	1999	293	$35,010	$76,521
Coburn, John	COB	1925	–	652	$3,497	$6,386
Coleman William	COL	1922	1992	640	$1,103	$1,469
Crooke, Ray	CRO	1922	–	2020	$4,000	$6,472
Dargie, William	DAR	1912	–	176	$1,931	$4,317
Dickerson, Robert	DIC	1924	–	1628	$4,326	$8,121
Drysdale, George Russell	DRY	1912	1981	612	$32,940	$115,731
Duncan, George	DUN	1904	1974	111	$1,468	$1,898
Fairweather, Ian	FAI	1891	1974	170	$19,699	$29,316
French, Leonard	FRE	1928	–	221	$7,241	$13,237
Friend, Donald	FRI	1915	1989	1647	$4,272	$8,501
Fullbrook, Samuel	FUL	1922	–	189	$8,042	$10,575
Gascoigne, Rosalie	GAS	1917	1999	47	$34,501	$49,992
Gleeson, James Timothy	GLE	1915	–	587	$3,310	$7,225
Hart, Kevin Charles Pro	HAR	1928	–	1922	$1,442	$2,674
Haxton, Elaine	HAX	1909	1999	269	$3,860	$7,372
Heysen, Nora	HYN	1911	–	99	$3,158	$5,383
Hodgkinson, Frank	HOD	1919	2001	178	$1,526	$2,509
Jackson, James Ranalph	JAC	1882	1975	693	$5,894	$9,662
Kelly, John	KEL	1965	–	47	$34,045	$30,328
Klippel, Robert	KLI	1920	2001	96	$5,158	$12,028
Larter, Richard	LAR	1929	–	109	$4,193	$3,861
Lawrence, George	LAW	1901	1981	600	$2,721	$2,840
Maguire, Tim	MAG	1958	–	79	$9,761	$19,207
Nolan, Sidney	NOL	1917	1992	2405	$11,182	$42,852
Olley, Margaret	OLL	1923	–	278	$12,529	$15,930
Olsen, John	OLS	1928	–	1145	$9,118	$24,821
Perceval, John	PER	1923	2000	679	$14,133	$38,256
Pugh, Clifton	PUG	1924	1990	744	$4,528	$7,619
Rees, Lloyd	REE	1895	1988	997	$9,617	$20,669
Robinson, William	ROB	1936	–	80	$39,303	$52,664
Shead, Garry	SHE	1942	–	240	$9,025	$16,783
Smart, Frank Jeffrey	SMA	1921	–	295	$36,544	$51,774
Smith, Grace Cossington	SMI	1892	1984	257	$17,204	$30,323
Storrier, Tim	STO	1949	–	351	$10,140	$19,690
Thomas, Rover	THO	1926	1998	84	$35,217	$78,966
Tjapaltjarri, Clifford	TJA	1934	2003	80	$7,160	$15,670
Tucker, Albert	TUC	1914	1999	310	$14,764	$38,791
Vike, Harold	VIK	1906	1987	272	$1,486	$1,586
Waters, Maynard	WAT	1936	–	232	$967	$921
Wheeler, Charles	WHE	1881	1977	473	$1,760	$3,162
Whiteley, Brett	WHI	1939	1992	1000	$23,927	$82,465
Williams, Frederick	WIL	1927	1982	602	$21,305	$49,779
Acrylic	ACR	–	–	730	$13,993	$28,705
Gouache	GOU	–	–	766	$7,405	$11,473
Oil	OIL	–	–	14425	$13,661	$45,663
Watercolour	WCO	–	–	1674	$4,977	$8,003
All other medias		–	–	12632	$4,427	$21,666
Christies	CHR	–	–	4594	$17,671	$56,905
Deutscher-Menzies	DEU	–	–	1756	$26,050	$67,630
Sotheby's	SOT	–	–	4783	$19,560	$47,581
All other auction houses		–	–	19094	$2,971	$9,237

Table II. Estimated coefficients, standard errors and *p*-values for the hedonic pricing equation

Variable	Estimated coefficient	Standard error	*p*-value	Variable	Estimated coefficient	Standard error	p-value	Variable	Estimated coefficient	Standard error	*p*-value	Variable	Estimated coefficient	Standard error	*p*-value
ARK	0.2916	0.1243	0.0190	KLI	-0.0383	0.0977	0.6946	WSY	0.0026	0.0003	0.0000	Y78	-8.6950	2.0402	0.0000
BER	-0.4576	0.0740	0.0000	LAR	-1.1037	0.0953	0.0000	WSQ	0.0000	0.0000	0.0000	Y79	-8.6082	2.0404	0.0000
BLA	-0.1580	0.0365	0.0000	LAW	-0.7594	0.0528	0.0000	ACR	1.1725	0.0398	0.0000	Y80	-8.4293	2.0392	0.0000
BOO	0.2716	0.0977	0.0055	MAG	0.0184	0.1372	0.8935	GOU	1.0606	0.0359	0.0000	Y81	-8.2986	2.0387	0.0000
BYA	0.2041	0.0300	0.0000	OLL	0.0907	0.0627	0.1480	OIL	1.5050	0.0146	0.0000	Y82	-8.4832	2.0382	0.0000
BYD	-0.4416	0.0358	0.0000	OLS	0.3122	0.0413	0.0000	WCO	0.7885	0.0275	0.0000	Y83	-8.5327	2.0373	0.0000
BYJ	-1.0267	0.0990	0.0000	PER	0.6035	0.0436	0.0000	ARE	1.1760	0.0148	0.0000	Y84	-8.4110	2.0365	0.0000
BRA	0.8748	0.0605	0.0000	PUG	-0.2469	0.0434	0.0000	ASQ	-0.0866	0.0021	0.0000	Y85	-8.2824	2.0362	0.0000
COB	-0.6476	0.0466	0.0000	REE	-0.0894	0.0892	0.3160	CHR	0.8335	0.0164	0.0000	Y86	-8.0840	2.0353	0.0001
COL	-1.1702	0.0446	0.0000	ROB	1.0485	0.1101	0.0000	DEU	0.7106	0.0253	0.0000	Y87	-7.7660	2.0351	0.0001
CRO	-0.4559	0.0329	0.0000	SHE	0.0101	0.0791	0.8984	SOT	0.8578	0.0164	0.0000	Y88	-7.6788	2.0347	0.0002
DAR	-1.0522	0.0772	0.0000	SMA	1.1378	0.0613	0.0000	FEB	0.4943	0.1224	0.0001	Y89	-7.6863	2.0347	0.0002
DIC	0.3477	0.0348	0.0000	SMI	-0.0413	0.0995	0.6780	MAR	0.3529	0.1067	0.0009	Y90	-8.0536	2.0347	0.0001
DRY	1.2936	0.0460	0.0000	STO	0.1169	0.0860	0.1740	APR	0.4571	0.1061	0.0000	Y91	-8.1945	2.0346	0.0001
DUN	-0.9835	0.0914	0.0000	THO	1.5934	0.1052	0.0000	MAY	0.4033	0.1067	0.0002	Y92	-8.1932	2.0346	0.0001
FAI	0.7062	0.0871	0.0000	TJA	-0.6030	0.1131	0.0000	JUN	0.4337	0.1074	0.0001	Y93	-8.2521	2.0348	0.0001
FRE	0.3940	0.0698	0.0000	TUC	0.4678	0.0611	0.0000	JUL	0.5153	0.1066	0.0000	Y94	-8.2474	2.0351	0.0001
FRI	0.2373	0.0310	0.0000	VIK	-0.8509	0.0657	0.0000	AUG	0.4768	0.1062	0.0000	Y95	-8.2211	2.0350	0.0001
FUL	0.2339	0.0728	0.0013	WAT	-0.8530	0.0767	0.0000	SEP	0.3540	0.1079	0.0010	Y96	-8.1631	2.0352	0.0001
GAS	1.4260	0.1368	0.0000	WHE	-1.8926	0.1406	0.0000	OCT	0.2695	0.1075	0.0122	Y97	-8.0977	2.0357	0.0001
GLE	-0.8474	0.0508	0.0000	WHI	1.3616	0.0602	0.0000	NOV	0.4093	0.1057	0.0001	Y98	-8.0321	2.0359	0.0001
HAR	-0.9765	0.0383	0.0000	WIL	1.0715	0.0558	0.0000	DEC	0.0792	0.1097	0.4701	Y99	-7.7906	2.0366	0.0001
HAX	-0.9137	0.0712	0.0000	DTH	0.0058	0.0228	0.7994	Y73	-8.8663	2.0444	0.0000	Y00	-7.6817	2.0370	0.0002
HYN	-0.7592	0.0996	0.0000	AGE	0.8133	0.1384	0.0000	Y74	-8.6899	2.0452	0.0000	Y01	-7.6787	2.0375	0.0002
HOD	-1.3944	0.0749	0.0000	AGS	-0.0185	0.0034	0.0000	Y75	-8.8040	2.0433	0.0000	Y02	-7.7248	2.0377	0.0002
JAC	-0.8410	0.1050	0.0000	AG3	0.0002	0.0000	0.0000	Y76	-8.9651	2.0422	0.0000	Y03	-7.4207	2.0377	0.0003
KEL	1.2718	0.1747	0.0000	AG4	0.0000	0.0000	0.0000	Y77	-9.0080	2.0391	0.0000				

$R^2 = 0.6745$, log-likelihood = -39564.20

Table III. Australian modern and contemporary art and stock indices and index returns

Year	Art index	Art returns	Stock index	Stock returns
1973	100		100	
1974	119	17.64%	75	-28.93%
1975	106	-11.41%	70	-7.07%
1976	91	-16.12%	85	20.29%
1977	87	-4.28%	82	-4.56%
1978	119	31.30%	92	12.45%
1979	129	8.68%	114	20.99%
1980	155	17.88%	169	39.52%
1981	176	13.07%	179	5.65%
1982	147	-18.46%	138	-26.37%
1983	140	-4.95%	173	23.11%
1984	158	12.18%	200	14.09%
1985	179	12.86%	245	20.45%
1986	219	19.84%	331	30.10%
1987	301	31.81%	485	38.14%
1988	328	8.71%	405	-17.97%
1989	325	-0.75%	433	6.76%
1990	225	-36.72%	410	-5.65%
1991	196	-14.09%	413	0.92%
1992	196	0.13%	428	3.60%
1993	185	-5.90%	494	14.33%
1994	186	0.48%	565	13.37%
1995	191	2.63%	553	-2.18%
1996	202	5.81%	619	11.26%
1997	216	6.53%	700	12.25%
1998	230	6.57%	724	3.45%
1999	293	24.14%	792	8.99%
2000	327	10.89%	846	6.53%
2001	328	0.30%	866	2.40%
2002	313	-4.61%	843	-2.68%
2003	424	30.41%	817	-3.11%

The art index value is calculated as $100e^{\beta t}$. The annual returns for both the art and stock index are continuously compounded or log returns.