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Financial Returns and Price Determinants in the Australian Art Market, 1973–2003*

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In this study, 37 605 paintings by 60 well-known 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 and living status of the artist, the size and medium of the painting and the auction house and year in which the painting was sold. The resulting index indicates that returns on Australian fine-art averaged 7 per cent over the period with a standard deviation of 16 per cent. The hedonic regression model also captures the willingness to pay for perceived attributes in the artwork, and this shows that works by McCubbin, Gascoigne, Thomas and Preston and other artists deceased at the time of auction, works executed in oils or acrylic, and those auctioned by Sotheby's or Christie's are associated with higher prices.

I Introduction

With the end of the long bull market in equity, and now with falling property values, many international investors are turning to art (paintings, sculpture, ceramics and prints, along with collectibles such as coins, stamps, antiques and furniture) as an alternative investment. Though memories remain strong of the downturn in the art market in the early 1990s, the fine-art resurgence in the final years of the last century, especially of Old Masters and Modern paintings, suggests that global art markets have developed and matured, and now offer more viable investment prospects (Anonymous, 2000). With some financial advisors suggesting exposure to the art market up to 15 per cent of personal assets, the periodic revival of interest in art by the corporate world (see Curry (1998), Oleck and Dunkin (1999), Peers and Jeffrey (1999) and Reid (2004)), and the widespread availability of market information (see Art Market Research (2004)), art stands out as an irresistible combination of pleasure and profit in otherwise staid, electronic or paper-strewn portfolios.

In Australia too, there is burgeoning interest in art investment generally, and in the work of Australian artists more particularly. Although Australia has a long history of world-renowned artists, including Frederick McCubbin, Arthur Streeton, Tom Roberts and Arthur Boyd, in the last few decades painters like Charles Blackman, David Boyd, Ray Crooke and John Olsen have also produced numerous internationally reputable works. And many of these more recent Australian works have also realised high returns. In 2003, David Boyd's brightly coloured *Children Flying Kites* commanded a soaring price of $35 000 when the original estimate was just $12 000 to $18 000 and a large painting by John Olsen bought for $138 000 in 1999 was sold for $245 700 (Ingram, 2003).

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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. A surging interest in Aboriginal art is also evident in the last decade, particularly in works by Rover Thomas and Clifford (Possum) Tjapaltjarri. Rover Thomas, for example, set a personal record of $778 750 for *All That Big Rain Coming From Top Side* in 2001. Fine-art auction houses are now struggling to keep up with the increased demand for Australian paintings, especially if the artists are included among the 50 most collectable by the Australian Art Collector magazine.

One patently useful source of information for those collectors, investors, galleries, auction houses and museums interested in Australian art is an index of market price movements. Such indexes allow not only the assessment of general movements in art prices and returns over time, and thereby a means to compare its performance with other assets, but also permit the comparison of returns by individual artists with a market benchmark, and are potentially useful as an input in asset pricing and risk management models. Regrettably, and in sharp contrast to most other artistic collections by nationality, there is no known price index of Australian work. This is a clear omission in the economics of art literature. For example, Buelens and Ginsburgh (1993) calculated price indices for works by English, Dutch and Italian painters, Agnello and Pierce (1996) created an index of average price movements of leading American artists, Pesando and Shum (1999) used French auction prices to construct a semiannual 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 purpose of this paper is to fill this gap in the literature by investigating the price determinants and investment returns for works by creating an Australian art market index. The index is derived from a hedonic pricing equation capturing the characteristics of artwork by 60 well-known Australian artists auctioned over the period 1973–2003. The paper itself is organised as follows. Section II outlines the empirical methodology, whereas section III provides a description of the data employed. The empirical results are dealt with in section IV. The paper ends with some concluding remarks in section V.

II Empirical Methodology

Three principal methods have been used for calculating art indices: (i) the naïve art index method; (ii) the repeat-sales index method; and (iii) the hedonic price index method. In brief, the naïve art index method tracks the changing value of a fixed basket of paintings. The repeat-sales index method follows the changes in value of resold paintings. The final approach is the hedonic price index method. In this approach, all sales (including repeat sales) are considered as single sales for which the objective features are recorded (e.g. name of the painter, size of painting, medium of execution etc.). Combining all sales allows the implicit (or hedonic) prices for these characteristics to be estimated separately from a characteristic-free price of paintings including only the effect of time and random error.

A clear advantage is that all auction data are used. The main disadvantage is that often only a few characteristics of each painting are gathered together in any given dataset (usually auction records). Buelens and Ginsburgh (1993), de la Barre *et al*. (1994), Chanel (1995) and Agnello and Pierce (1996) have used the hedonic price index method to estimate art price indices, with Chanel (1995) concluding that while the market-wide effect was unbiased in both the repeat-sales and hedonic price index methods, the variance of the coefficient estimates for the latter were much smaller. Moreover, there is no need to undertake the somewhat difficult task of identifying resales in large datasets. This is a problem with the data in this analysis as the records often include only generic titles insufficient to identify individual works. Regardless, over a 30-year period the number of potential resales is not likely to be large. As an example, in Locatelli Biey and Zanola's (1999) sample of 200 000 international art sales, just 1 669 were re-sales.

The approach selected for the current analysis is the hedonic price index method following the seminal theoretical contribution of Rosen (1974). Assuming the availability of comprehensive data, the hedonic price index method's main 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:

$$\ln p_{kt} = f(X_{1kt}, \ldots, X_{mkt}, \ldots, X_{Mkt}) + g(t) + \varepsilon_{kt} \quad (1)$$

where $\ln p_{kt}$ is the natural logarithm of the price of painting $k(k = 1, \ldots, K)$ sold in year $t(t = 1, \ldots, T)$, X_{mkt} is the measurable characteristics $m(m = 1, \ldots, M)$ of painting k at time t, $g(t)$ is a function of time, and the error term $\varepsilon \sim N(0, \Sigma_k \otimes I_T)$. The measurable characteristics of the paintings comprise the personal characteristics of the artist who painted

the work, the physical characteristics of the work itself, and characteristics of the auction at which the sale of the work took place. The regression equation is then specified as:

$$\ln p_{kt} = \sum_{m=1}^{M} \alpha_m X_{mkt} + \sum_{t=1}^{T} \beta_t Z_t + \varepsilon_{kt} \qquad (2)$$

where 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 is a parameter estimate, $e^{\beta t}$ gives the art price index and all other variables are as previously defined. Importantly, the nature of the data used in this and other hedonic art price indexes (unbalanced panel data with many missing values) precludes the use of advanced time-series regression techniques, so the log-linear regression equation is estimated using least-squares (effectively fixed effects with respect to both cross-sections and time).

The data comprise 37 605 sales transactions of artworks by 60 leading Australian artists. Information on sales is obtained from Australian Art Auction Records (2003) and spans the period from 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 various art auctioneers, curators and dealers on those artistic works most sought after and frequently sold at auction in the past 30 years. Its construction is also reflective, in so far is possible, of the widest number of periods, schools and genres in Australian art history and is purposively restricted to artists who lived most of their lifetime in Australia.

The first set of information gathered is the price of each artwork. This comprises the dependent variable in the hedonic price regression. Each artwork included is sold exclusively at public auction and its value specified in Australian dollars. It is not known whether there is potential systematic upward or downward bias in any price index using this data. Because the price obtained in auctions is the outcome of a competitive process it could be suggested that the prices used are lower than those from expert valuations and those in galleries. On the other hand, auction prices are argued to be artificially high as auction houses have financial overheads not shared by art galleries, while large auction houses may also exercise market power to attract more valuable works. However, as the true or intrinsic value is not observable, it is not possible to make a definitive statement on whether there is systematic under or overbidding in the Australian auction market at all times.

The next three sets of variables are considered to be major determinants of the price of an individual artwork and are specified as explanatory variables in the hedonic pricing regression. The first set of explanatory variables relate to the personal 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 personal 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 and subject matter, historical importance and medium. For instance, most artists are ordinarily identified with a single school or movement throughout their careers, such as James Gleeson and Surrealism. Artists Inc. cover famous artistic dynasties (Arthur, David and Jamie Boyd and Hans and Nora Heysen), members of the renowned Heidelberg school (Frederick McCubbin, Arthur Streeton and Tom Roberts) and Aboriginal artists (Albert Namatjira and Clifford Tjapaltjarri). Dummy variables are used to link each artist with their work with Howard Arkley being the reference category. A full listing of the artists, their year of birth and death (if applicable) and the number of works included in the sample are given in Table 1. The oldest born artists in the sample are John Glover (1767) and Walter Withers (1854) and the youngest born are Tim Maguire (1958) and John Kelly (1965). The number of works sold range from 47 (Rosalie Gascoigne and John Kelly) to 3132 (Norman Lindsay). On average, 626 works for each artist are included in the sample.

A second personal 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. However, as the sample of artists is drawn across a very long time period, the effect may be less than if only works from artists who were still living or died during the sample period were included. Of the 60 artists, 19 died before the sample period, 20 during this period and 21 are still living.

The second set of variables represents the physical characteristics of the artwork. The first group are dummy variables identifying the medium of the work: namely, acrylic (*ACR*), charcoal (*CHA*), crayon (*CRA*), etching (*ETC*), the heavy, opaque watercolour paint known as gouache (*GOU*), mixed media (*MIX*),

TABLE 1
Selected Descriptive Statistics of Artwork Prices by Artist, Medium and Auction House

Description	Variable	Born	Died	Works Sold	Mean	Standard Deviation	Coefficient of Variation	Skewness	Kurtosis	Jarque-Bera	JB *P*-value
Arkley, Howard		1951	1999	87	$23 126	$45 798	1.98	4.14	23.44	1.76E + 03	0.00
Ashton, John	ASH	1881	1963	970	$2649	$3782	1.43	3.64	22.13	1.69E + 04	0.00
Beckett, Clarice	BEC	1887	1935	173	$9579	$13 311	1.39	3.43	17.46	1.85E + 03	0.00
Blackman, Charles	BLA	1928	–	2361	$8006	$20 495	2.56	7.64	92.22	8.06E + 05	0.00
Booth, Peter	BOO	1940	–	119	$6248	$15 966	2.56	6.76	57.67	1.57E + 04	0.00
Boyd, Arthur	BYA	1920	1999	1797	$20 426	$57 305	2.81	9.37	121.65	1.08E + 06	0.00
Boyd, David	BYD	1924	–	1645	$2693	$2772	1.03	8.44	162.12	1.75E + 06	0.00
Boyd, Jamie	BYJ	1948	–	178	$796	$872	1.10	1.83	6.18	1.74E + 02	0.00
Brack, Cecil John	BRA	1920	1999	293	$35 010	$76 521	2.19	3.41	16.15	2.68E + 03	0.00
Bunny, Rupert	BUN	1864	1947	527	$23 837	$75 640	3.17	9.83	139.47	4.17E + 05	0.00
Coburn, John	COB	1925	–	652	$3497	$6386	1.83	3.58	18.01	7.51E + 03	0.00
Crooke, Ray	CRO	1922	–	2020	$4000	$6472	1.62	4.45	29.24	6.46E + 04	0.00
Dargie, William	DAR	1912	–	176	$1931	$4317	2.24	7.06	63.28	2.81E + 04	0.00
Dickerson, Robert	DIC	1924	–	1628	$4326	$8121	1.88	4.86	34.27	7.27E + 04	0.00
Drysdale, George Russell	DRY	1912	1981	612	$32 940	$115 731	3.51	6.24	48.36	5.64E + 04	0.00
Duncan, George	DUN	1904	1974	111	$1468	$1898	1.29	2.70	10.80	4.16E + 02	0.00
Fairweather, Ian	FAI	1891	1974	170	$19 699	$29 316	1.49	3.54	21.11	2.68E + 03	0.00
Fizelle, Reginald Cecil	FIZ	1891	1964	136	$1564	$4762	3.05	7.68	66.14	2.39E + 04	0.00
Fox, Ethel	FOX	1872	1952	334	$10 172	$20 197	1.99	5.67	54.47	3.87E + 04	0.00
Friend, Donald	FRI	1915	1989	1647	$4272	$8501	1.99	8.75	133.24	1.19E + 06	0.00
Fullbrook, Samuel	FUL	1922	–	189	$8042	$10 575	1.31	2.56	10.78	6.84E + 02	0.00
Gascoigne, Rosalie	GAS	1917	1999	47	$34 501	$49 992	1.45	3.14	15.67	3.91E + 02	0.00
Gleeson, James Timothy	GLE	1915	–	587	$3310	$7225	2.18	5.53	39.09	3.49E + 04	0.00
Glover, John	GLO	1767	1849	315	$10 572	$48 580	4.60	11.00	141.55	2.57E + 05	0.00
Gruner, Elioth	GRU	1882	1939	386	$11 195	$14 824	1.32	2.68	12.91	2.04E + 03	0.00
Hart, Kevin Charles Pro	HAR	1928	–	1922	$1442	$2674	1.85	18.23	517.25	2.13E + 07	0.00
Hester, Joy	HES	1920	1960	96	$9785	$24 206	2.47	6.48	51.26	9.99E + 03	0.00
Heysen, Hans	HYH	1877	1968	1200	$8571	$16 653	1.94	8.30	101.33	4.97E + 05	0.00
Heysen, Nora	HYN	1911	–	99	$3158	$5383	1.70	2.49	8.67	2.35E + 02	0.00
Hodgkinson, Frank	HOD	1919	2001	178	$1526	$2509	1.64	3.80	22.50	3.25E + 03	0.00
Jackson, James Ranalph	JAC	1882	1975	693	$5894	$9662	1.64	7.82	92.68	2.39E + 05	0.00
Kelly, John	KEL	1965	–	47	$34 045	$30 328	0.89	1.07	3.23	9.10E + 00	0.01
Klippel, Robert	KLI	1920	2001	96	$5158	$12 028	2.33	3.75	17.63	1.08E + 03	0.00
Larter, Richard	LAR	1929	–	109	$4193	$3861	0.92	1.36	4.69	4.67E + 01	0.00
Lindsay, Norman	LIN	1879	1969	3132	$5822	$13 657	2.35	8.16	109.35	1.51E + 06	0.00
Long, Sydney	LON	1871	1955	873	$4073	$8702	2.14	9.33	146.12	7.58E + 05	0.00
Maguire, Tim	MAG	1958	–	79	$9761	$19 207	1.97	2.93	11.57	3.55E + 02	0.00
McCubbin, Frederick	MCC	1855	1917	269	$55 245	$171 014	3.10	7.77	82.03	7.27E + 04	0.00
Namatjira, Albert	NAM	1902	1959	593	$7339	$6132	0.84	1.25	5.05	2.57E + 02	0.00

TABLE 1
Continued

Description	Variable	Born	Died	Works Sold	Mean	Standard Deviation	Coefficient of Variation	Skewness	Kurtosis	Jarque-Bera	JB *P*-value
Nolan, Sidney	NOL	1917	1992	2405	$11 182	$42 852	3.83	15.23	335.45	1.12E+07	0.00
Olley, Margaret	OLL	1923	–	278	$12 529	$15 930	1.27	1.76	5.82	2.36E+02	0.00
Olsen, John	OLS	1928	–	1145	$9118	$24 821	2.72	10.35	155.72	1.13E+06	0.00
Perceval, John	PER	1923	2000	679	$14 133	$38 256	2.71	8.17	91.01	2.27E+05	0.00
Preston, Margaret	PRE	1875	1963	380	$12 470	$26 244	2.10	6.59	69.81	7.34E+04	0.00
Proctor, Althea	PRO	1879	1966	340	$1867	$3072	1.65	4.10	28.21	9.96E+03	0.00
Rees, Lloyd	REE	1895	1988	997	$9617	$20 669	2.15	4.25	25.15	2.34E+04	0.00
Roberts, Thomas	RBT	1856	1931	253	$24 168	$48 848	2.02	4.37	25.52	6.15E+03	0.00
Robinson, William	ROB	1936	–	80	$39 303	$52 664	1.34	2.00	7.09	1.09E+02	0.00
Russell, John Peter	RUS	1859	1930	126	$45 167	$100 079	2.22	3.86	20.57	1.93E+03	0.00
Shead, Garry	SHE	1942	–	240	$9025	$16 783	1.86	2.65	10.87	8.99E+02	0.00
Smart, Frank Jeffrey	SMA	1921	–	295	$36 544	$51 774	1.42	2.29	8.75	6.64E+02	0.00
Smith, Grace Cossington	SMI	1892	1984	257	$17 204	$30 323	1.76	5.06	37.46	1.38E+04	0.00
Storrier, Tim	STO	1949	–	351	$10 140	$19 690	1.94	3.86	25.61	8.35E+03	0.00
Streeton, Arthur	STR	1867	1943	790	$31 800	$61 587	1.94	6.13	59.44	1.10E+05	0.00
Thomas, Rover	THO	1926	1998	84	$35 217	$78 966	2.24	7.28	61.32	1.26E+04	0.00
Tjapaltjarri, Clifford	TJA	1934	2003	80	$7160	$15 670	2.19	5.38	36.16	4.05E+03	0.00
Tucker, Albert	TUC	1914	1999	310	$14 764	$38 791	2.63	11.68	170.20	3.68E+05	0.00
Whiteley, Brett	WHI	1939	1992	1000	$23 927	$82 465	3.45	12.22	228.22	2.14E+06	0.00
Williams, Frederick	WIL	1927	1982	602	$21 305	$49 779	2.34	5.34	41.10	3.93E+04	0.00
Withers, Walter	WTH	1854	1914	368	$12 097	$30 502	2.52	6.96	68.10	6.80E+04	0.00
Acrylic	ACR	–	–	717	$14 193	$28 925	2.04	4.85	35.63	3.46E+04	0.00
Chacoal	CHA	–	–	995	$3424	$9133	2.67	17.50	421.77	7.32E+06	0.00
Crayon	CRA	–	–	254	$1979	$3101	1.57	3.39	16.95	2.55E+03	0.00
Etching	ETC	–	–	3113	$1389	$1943	1.40	6.21	71.65	6.31E+05	0.00
Gouache	GOU	–	–	635	$9044	$13 034	1.44	2.97	16.90	6.05E+03	0.00
Mixed media	MIX	–	–	891	$5957	$15 762	2.65	18.47	444.44	7.29E+06	0.00
Oil	OIL	–	–	16 44	$17 363	$54 202	3.12	13.18	307.83	6.42E+07	0.00
Pastel	PAS	–	–	1010	$4682	$7268	1.55	5.65	58.65	1.36E+05	0.00
Pencil	PEN	–	–	1459	$2196	$3531	1.61	4.37	29.99	4.89E+04	0.00
Watercolour	WCO	–	–	4164	$7176	$9685	1.35	4.43	42.10	2.79E+05	0.00
All other medias		–	–	7919	$5124	$26 503	5.17	23.09	781.43	2.01E+08	0.00
Australian Art Auctions	AUS	–	–	2900	$2156	$3880	1.80	7.39	91.70	9.77E+05	0.00
Christies	CHR	–	–	6012	$18 401	$55 406	3.01	13.22	290.36	2.09E+07	0.00
Deutscher-Menzies	DEU	–	–	1886	$27 412	$70 092	2.56	6.80	66.26	3.29E+05	0.00
James Lawson	JAM	–	–	4330	$2748	$5756	2.09	7.21	83.97	1.22E+06	0.00
Leonard Joel	LEO	–	–	8720	$4283	$20 199	4.72	37.87	2001.32	1.45E+09	0.00
Sotheby's	SOT	–	–	6039	$21 022	$48 016	2.28	9.27	137.30	4.63E+06	0.00
All other auction houses		–	–	7718	$6305	$34 171	5.42	35.69	1914.95	1.18E+09	0.00

oil (*OIL*), pastel (*PAS*), pencil (*PEN*) and watercolour (*WCO*). The reference category is all other mediums. Of the mediums included in the analysis, the largest numbers of works sold during the sample period are *WCO* followed by *ETC* and then *OIL*. However, the most desirable medium is usually oil because many high-quality works are executed in this durable and difficult-to-work media, though a variety of other potentially valuable media are found in most fine-art collections. The second group of physical characteristic 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 nonlinear 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). Of course, there are any number of other physical characteristics that could be included if data were available. These include the painting's genre, providence and the date it was completed. A number of candidate characteristics were included in a series of exploratory regressions, including the artist's age and number of works sold each year, but these never added explanatory power.

The final set of explanatory variables incorporate the sales characteristics of the work. The first of these are dummy variables identifying in which of the six major auction houses the sale took place: that is, Australian Art Auctions (*AUS*), Christies (*CHR*), Deutscher-Menzies (*DEU*), James Lawson (*JAM*), Leonard Joel (*LEO*) and Sotheby's (*SOT*). The reference category is all other auction houses. During the sample period, the largest number of works was sold through *LEO*, followed by *SOT* and then *CHR*. 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), among others, have found that Christies and Sotheby's systematically obtain higher hammer prices, chiefly because of reputation and market power. The second set of sales characteristics identifies the year when the work is sold. This consists of 30 yearly dummy variables with 1973 as the reference category. Accordingly, 1973 provides the base period for the index.

III Properties of the Data

Selected descriptive statistics of artwork prices as the dependent variable are provided in Table 1. The first part of the table presents these statistics grouped according to the 60 artists (including the reference artist, Howard Arkley), the second part grouped according to the 10 types of media (plus the reference group, others mediums) and the third by the seven auction houses (with the reference group, other auction houses). Samples means and standard deviations are presented, along with measures of skewness and kurtosis, the coefficient of variation and the Jarque-Bera statistic and its *P*-value.

Turning first to the prices of artworks by artist, the average price achieved for each artist's work ranges from $796.46 for paintings by Jamie Boyd (*BYJ*) to $55 244.61 for those by Frederick McCubbin (*MCC*). Other artists whose paintings have a high average value are John Peter Russell (*RUS*), William Robinson (*ROB*), Jeffrey Smart (*SMA*) and Rover Thomas (*THO*) with means of $45 167, $39 303, $36 544 and $35 217, respectively. On average, the lowest prices are for works by Pro Hart (*HAR*), George Duncan (*DUN*), Frank Hodgkinson (*HOD*) and Reginald Fizelle (*FIZ*) with average prices of $1 442, $1 468, $1 526 and $1 564, respectively.

The standard deviations of art prices range from $872 to $171 014. On this basis, works by *BYJ*, *DUN*, *HOD*, *HAR* and David Boyd (*BYD*) are the least volatile with standard deviations of $872, $1 898, $2 509, $2 674 and $2 772, respectively, whereas works by *MCC*, George Russell Drysdale (*DRY*), *RUS*, Brett Whiteley (*WHI*) and *THO* are the most volatile with standard deviations of $171 014, $115 731, $100 079, $82 465 and $78 966, respectively. According to the coefficient of variation, which measures the standard deviation relative to the mean, the prices of paintings by John Glover (*GLO*) and Sidney Nolan (*NOA*) are some of the most variable, with works by Albert Namatjira (*NAM*) and John Kelly (*KEL*) less variable.

By and large, the distributional properties of the artwork prices appear non-normal. The measures of skewness are all positive and range from 1.07 (*KEL*) to 18.23 (*HAR*). Because the asymptotic sampling distribution of skewness is normal with a mean of zero and standard deviation of $\sqrt{6/n}$ where n is the sample size, and given that the smallest sample size is 47, the standard deviation under the null hypothesis of normality is 0.3573. All estimates of skewness are then significant at the 0.05 level of significance or lower, suggesting a long right tail of high prices for work by all 60 artists. The kurtosis, or degree of excess, for all artists is also larger than three, ranging from 3.23 (*KEL*) to 517.25 (*HAR*), therefore all of these series can be represented by a leptokurtic (or fat-tailed) distribution. Given the sampling distribution of kurtosis is normal with a mean of zero and standard

deviation of $\sqrt{24/n} = 0.7146$ (for the smallest sample size of 47), then all estimates are once again statistically significant at any conventional level. The calculated Jarque-Bera statistics and corresponding *P*-values in Table 1 are used to test the null hypothesis that the distribution for the art prices is normally distributed. All *P*-values are less than the 0.01 level of significance indicating that the prices are not well approximated by a normal distribution.

Table 1 also includes the descriptive measures of art prices categorised according to the 10 different types of media. Of these, the prices for *OIL* and *ACR* are respectively the most expensive, averaging $17 363 and $14 193, and the cheapest are *ETC* and *CRA*, averaging $1 389 and $1 979, respectively. The most volatile prices are also for *OIL* and *ACR* with standard deviations of $54 202 and $28 925, respectively and the least volatile are *ETC* and *CRA* with standard deviations of $1 943 and $3 101, respectively. The distributional properties of art prices across the different media are likewise non-normal, positively skewed and leptokurtic. Finally, descriptive measures of the sales by auction house are also presented in Table 1. Generally, *DEU*, *SOT* and *CHR* achieved the highest prices for art sold over the sample period, averaging $27 412, $21 022 and $18 401, respectively. The most volatile sale prices are those for *DEU* and *CHR* with standard deviations of $70 092 and $55 406, respectively, and the least volatile sales prices are from *AUS* with a standard deviation of $3 880 and *JAM* with a standard deviation of $5 756. As before, the distributional properties of art prices by auction houses are positively skewed, leptokurtic and non-normal.

IV Empirical Results

The estimated coefficients of the hedonic pricing regression model are presented in Table 2. Because the null hypothesis of no heteroscedasticity in the least-squares residuals was initially rejected using White's (1980) test (*F*-statistic = 125.83, *P*-value = 0.0000), the standard errors and *P*-values incorporate White's (1980) corrections for an unknown form of heteroscedasticity. Also, included are the percentage effect of a unit change for the zero–one dummy variables and the elasticity (at the means) for the continuous variables. The estimated model is highly significant, with a likelihood ratio test of the hypothesis that all slope coefficients are zero rejected at the 1 per cent level using the likelihood ratio statistic. The adjusted R^2 of 0.6798 is high for cross-sectional data. The estimated parameters also appear sensible in terms of both the precision of the estimates and the signs on the coefficients. In fact, the only insignificant coefficient is *PEN*. To test for multicolinearity, variance inflation factors are calculated (not shown). As a rule of thumb, a variance inflation factor (VIF) significantly greater than 10 indicates the presence of harmful colinearity. Among the explanatory variables the highest VIF are for non-living artists at the time of the auction (10.8522), Norman Lindsay (10.6805), auction year 2001 (8.1386), auction year 2002 (7.9153) and Charles Blackman (7.7395). The average VIF is just 3.2292. This suggests that multicolinearity, while present, is not too serious a problem.

Turning first to the personal characteristics, significantly higher values are placed on the works by *MCC*, Rosalie Gascoigne (*GAS*), *THO*, Margaret Preston (*PRE*) and Tom Roberts (*RBT*) associated with percentage price increases of 252.3076, 190.2854, 156.6903, 154.5391 and 153.6036 per cent over the standard painting, respectively. Conversely, lower values are placed on artworks by *DUN*, Clifford (Possum) Tjapaltjarri (*TJA*), *HOD*, Richard Larter (*LAR*) and *BYJ* with percentage increases over the standard painting of just 11.2269, 9.6602, 9.1616, 7.6688 and 6.7973 per cent, respectively. A deceased artist at the time of auction (*DTH*) is associated with a price increase of 1.1338 per cent. However, as 39 of the 60 artists (65 per cent) included in the sample are deceased before or die during the auction period, this effect may be less than a smaller sample of contemporary artists restricted to those still living, or those who die during the auction period itself. By way of comparison, Agnello and Pierce (1996, p. 368) found a 154 per cent 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'. 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 personal characteristics are jointly insignificant rejected at any conventional level (*F*-statistic = 337.73, *P*-value = 0.0000).

The physical characteristics in the regression model comprise the medium of execution (i.e. oil, acrylic, charcoal, crayon, gouache etc.) and the size of the work. To start with, and as hypothesised, the percentage changes in value in Table 2 indicate that works executed in *ACR* and *OIL* command higher prices, with percentage increases over the standard work of 6.1522 and 6.0376 per cent, respectively. As justification, oil as a medium is more permanent, does not easily fade in natural light, and is therefore more likely to fetch higher prices. Acrylic, as a relatively modern alternative, also commands high prices at auction.

TABLE 2
Estimated Coefficients, Standard Errors and Percentage Changes in Price for the Hedonic Pricing Equation

Variable	Estimated Coefficient	Standard error	*P*-value	Percentage change	Variable	Estimated Coefficient	Standard Error	*P*-value	Percentage Change	Variable	Estimated Coefficient	Standard Error	*P*-value	Percentage Change
ASH	3.1686	0.0978	0.0000	23.7738	MCC	5.5306	0.1089	0.0000	252.3076	AUS	−0.4693	0.0187	0.0000	0.6254
BEC	3.6994	0.1093	0.0000	40.4230	NAM	4.5608	0.1003	0.0000	95.6608	CHR	0.6154	0.0179	0.0000	1.8504
BLA	3.5336	0.0915	0.0000	34.2476	NOL	3.7521	0.0950	0.0000	42.6123	DEU	0.5881	0.0275	0.0000	1.8006
BOO	3.1215	0.1110	0.0000	22.6798	OLL	3.6629	0.1045	0.0000	38.9742	JAM	−0.1376	0.0168	0.0000	0.8715
BYA	4.0767	0.0933	0.0000	58.9501	OLS	3.8074	0.0942	0.0000	45.0312	LEO	−0.0677	0.0145	0.0000	0.9345
BYD	3.2169	0.0906	0.0000	24.9510	PER	4.2980	0.0979	0.0000	73.5545	SOT	0.6437	0.0183	0.0000	1.9036
BYJ	1.9165	0.1081	0.0000	6.7973	PRE	5.0404	0.1046	0.0000	154.5391	1974	0.9978	0.0931	0.0000	2.7124
BRA	4.6074	0.1065	0.0000	100.2271	PRO	3.9059	0.1038	0.0000	49.6965	1975	0.9325	0.0932	0.0000	2.5408
BUN	4.2456	0.1044	0.0000	69.8000	REE	4.5423	0.0958	0.0000	93.9021	1976	0.7841	0.0912	0.0000	2.1905
COB	2.9454	0.0964	0.0000	19.0179	RBT	5.0344	0.1120	0.0000	153.6036	1977	0.7902	0.0952	0.0000	2.2038
CRO	3.2710	0.0912	0.0000	26.3366	ROB	4.1269	0.1400	0.0000	61.9852	1978	1.0652	0.0937	0.0000	2.9015
DAR	2.8086	0.1073	0.0000	16.5867	RUS	4.8441	0.1404	0.0000	126.9939	1979	1.2671	0.0891	0.0000	3.5506
DIC	3.6100	0.0933	0.0000	36.9674	SHE	3.2600	0.1081	0.0000	26.0491	1980	1.5716	0.0899	0.0000	4.8144
DRY	4.9792	0.1003	0.0000	145.3533	SMA	4.7980	0.1024	0.0000	121.2662	1981	1.7867	0.0899	0.0000	5.9698
DUN	2.4183	0.1172	0.0000	11.2269	SMI	4.3760	0.1060	0.0000	79.5211	1982	1.5618	0.0907	0.0000	4.7673
FAI	4.7196	0.1136	0.0000	112.1251	STO	3.1119	0.1048	0.0000	22.4630	1983	1.5179	0.0910	0.0000	4.5626
FIZ	2.9653	0.1212	0.0000	19.4015	STR	4.9411	0.1004	0.0000	139.9214	1984	1.7992	0.0902	0.0000	6.0447
FOX	3.7055	0.1117	0.0000	40.6723	THO	5.0543	0.1520	0.0000	156.6903	1985	2.0042	0.0906	0.0000	7.4202
FRI	3.9835	0.0940	0.0000	53.7063	TJA	2.2680	0.1715	0.0000	9.6602	1986	2.1372	0.0896	0.0000	8.4757
FUL	3.7650	0.1041	0.0000	43.1632	TUC	4.2320	0.0993	0.0000	68.8544	1987	2.4483	0.0891	0.0000	11.5684
GAS	5.2485	0.1848	0.0000	190.2854	WHI	4.6711	0.0961	0.0000	106.8190	1988	2.5749	0.0877	0.0000	13.1296
GLE	3.0428	0.0950	0.0000	20.9635	WIL	4.4182	0.0985	0.0000	82.9504	1989	2.6390	0.0880	0.0000	13.9988
GLO	4.0201	0.1108	0.0000	55.7042	WTH	4.4360	0.1069	0.0000	84.4359	1990	2.2716	0.0877	0.0000	9.6947
GRU	4.4129	0.1034	0.0000	82.5045	DTH	0.1256	0.0240	0.0000	1.1338	1991	2.1660	0.0874	0.0000	8.7232
HAR	2.5879	0.0912	0.0000	13.3021	ACR	1.8168	0.0546	0.0000	6.1522	1992	2.2130	0.0877	0.0000	9.1432
HES	4.5190	0.1415	0.0000	91.7424	CHA	0.6086	0.0334	0.0000	1.8378	1993	2.1143	0.0876	0.0000	8.2834
HYH	4.7219	0.0978	0.0000	112.3773	CRA	0.3928	0.0521	0.0000	1.4811	1994	2.1321	0.0867	0.0000	8.4323
HYN	3.2503	0.1372	0.0000	25.7987	ETC	−0.1965	0.0199	0.0000	0.8216	1995	2.1789	0.0879	0.0000	8.8363
HOD	2.2150	0.1070	0.0000	9.1616	GOU	1.3292	0.0351	0.0000	3.7781	1996	2.3280	0.0867	0.0000	10.2577
JAC	3.7287	0.0991	0.0000	41.6243	MIX	1.1082	0.0317	0.0000	3.0289	1997	2.4172	0.0872	0.0000	11.2145
KEL	3.7762	0.1788	0.0000	43.6495	OIL	1.7980	0.0204	0.0000	6.0376	1998	2.5539	0.0864	0.0000	12.8577
KLI	3.7179	0.1726	0.0000	41.1767	PAS	1.1314	0.0336	0.0000	3.0999	1999	2.8340	0.0862	0.0000	17.0137
LAR	2.0372	0.1375	0.0000	7.6688	PEN	−0.0133	0.0283	0.6377	0.9868	2000	2.9713	0.0896	0.0000	19.5174
LIN	4.8028	0.0946	0.0000	121.8452	WCO	1.1281	0.0215	0.0000	3.0899	2001	2.9629	0.0868	0.0000	19.3541
LON	4.0749	0.0978	0.0000	58.8468	ARE	1.2484	0.0148	0.4095	3.4847	2002	2.9013	0.0879	0.0000	18.1978
MAG	2.8178	0.1517	0.0000	16.7402	ASQ	−0.0932	0.0021	−0.0365	0.4053	2003	3.0879	0.0890	0.0000	21.9299

By comparison, media such as *ETC*, *CRA* and *CHA* are associated with respective percentage increases of just 0.8216, 1.4811 and 1.8378 per cent implying these media are generally more affordable, regardless of all other characteristics, while *GOU*, *MIX* and *PAS* have price increases of between 3.0289 and 3.7781 per cent. The estimated coefficient for *PEN* is not significant, even at the 0.10 level. Unfortunately, it is difficult to compare these findings because earlier studies are often limited to periods or movements when fewer media are generally known (de la Barre *et al*., 1994; Renneboog and Van Houtte, 2002) or to a single medium (Candela and Scorcu, 1997; Pesando and Shum, 1999). Nevertheless, Agnello and Pierce (1996) found a 156 per cent increase in prices for US oil works as compared to all other media (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 (1.2484) and the negative sign of its squared term (−0.0932) indicate that Australian 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 60 Australian artists is 6.70 m^2. By comparison, Agnello and Pierce (1996) found the price-maximising size for American artists' work to be 6.53 m^2 while de la Barre *et al*. (1994) calculated this optimal size to be 5.89 m^2 for Old Masters and 1.70 m^2 for Modern and Contemporary European works. A redundant variables test of the null hypothesis of the joint insignificance of the characteristics of the work is rejected at the 0.01 level (F-statistic = 2952.33, P-value = 0.0000).

The final set of variables relates to the sales characteristics of the works. The sales characteristics show that auctions at *SOT*, *CHR* and *DEU* increase the standard price by 1.9036, 1.8504 and 1.8006 per cent, respectively, over other auction houses. Alternatively, *AUS*, *JAM* and *LEO* are associated with systematically lower auction prices. One-tailed tests reject the null hypothesis that the estimated coefficient for Sotheby's is equal to Christies (F-statistic = 2.4204, P-value = 0.0599) or Deutscher-Menzies (F-statistic = 3.9502, P-value = 0.0235) in favour of the alternative hypotheses that the coefficient for Sotheby's is greater than that of Christies and Deutscher-Menzies. However, a similar one-tailed test fails to reject the null for the difference in coefficients between Christies and Deutscher-Menzies (F-statistic = 0.9821, P-value = 0.1629). The null hypothesis that the auction characteristics are jointly insignificant is rejected at the 0.01 level (F-statistic = 624.91, P-value = 0.0000).

Pesando (1993), de la Barre *et al*. (1994), Agnello and Pierce (1996) and Renneboog and Van Houtte (2002) also found that '. . .Sotheby's typically fetches higher prices than Christies, while both experience higher prices than all other houses' (Agnello and Pierce, 1996, p. 366). However, while variation in the prices obtained by the different auction houses are small, and certainly smaller than most other factors included in the model, care should still be taken in interpreting these differences as a violation of the law of one price. As an example, both Sotheby's and Christies usually 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, p. 65) likewise discussed this complication with the argument 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'.

Table 3 presents the Australian art index calculated using the hedonic price index method where the index value for the years 1973–2003 is calculated as $100e^{\beta t}$ set relative to a given base year value (1973 = 100). The yearly returns are also included in Table 3 such that the return in the art market is represented by the continuously compounded return or log return of the index at time t such that $\Delta p_t = \log(p_t/p_{t-1}) \times 100$ where Δp_t denotes the rate of change of p_t. The arithmetic mean return for the art index over the sampled period is 6.96 per cent with a standard deviation of 16.51 per cent. Given that when investing in any stock, bond, commodity or collectible the investor hopes to receive returns in excess of the inflation rate, the market appears sound with the consumer price index (CPI) averaging 6.56 per cent over the same period.

It would appear that the Australian art market has performed at a similar level to other national markets during the period 1973–2003. Renneboog and Van Houtte (2002), for example, found Belgian nominal average returns of 8.4 per cent over the period 1970–1989 with a standard deviation of 19.4 per cent; Agnello and Pierce (1996) estimated that the returns on American artists averaged 9.3 per cent from 1971 to 1992; and Mei and Moses (2001) calculated

TABLE 3
Art Index and Percentage Returns

Year	Index	Return
1973	100.00	
1974	99.72	−0.28
1975	93.41	−6.54
1976	80.53	−14.83
1977	81.02	0.61
1978	106.67	27.50
1979	130.54	20.19
1980	177.00	30.45
1981	219.48	21.51
1982	175.27	−22.49
1983	167.74	−4.39
1984	222.23	28.13
1985	272.80	20.50
1986	311.61	13.30
1987	425.31	31.11
1988	482.71	12.66
1989	514.66	6.41
1990	356.42	−36.74
1991	320.71	−10.56
1992	336.15	4.70
1993	304.54	−9.88
1994	310.01	1.78
1995	324.86	4.68
1996	377.12	14.92
1997	412.30	8.92
1998	472.71	13.67
1999	625.50	28.01
2000	717.55	13.73
2001	711.55	−0.84
2002	669.04	−6.16
2003	806.25	18.65

average returns of 5.3 per cent with a standard deviation of 9.3 per cent, also on American auctions, though over the period 1950–1999. Mean returns from other art studies include 1.6 per cent (Frey and Pommerehne, 1989), 6.8 per cent (Gerard-Varet, 1995) and 5.0 per cent (Goetzmann, 1996). Of course, the art returns as calculated do not reflect the fact that a substantial component of the return from art investment is derived not from its financial returns, rather from its intrinsic aesthetic qualities. Equally, they also do not include the many and sizeable transaction and holding costs associated with art portfolios, the absence of which may serve to inflate financial returns.

The pattern of Australian art market returns is also generally comparable to other studies in this area. Locatelli Biey and Zanola (1999, p. 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, p. 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]'. Of course, the long-run relationships between art and financial markets are beyond the scope of this paper and readers are directed to Chanel (1995), Ginsburgh and Jeanfils (1995), Czujack *et al.* (1996), Flores *et al.* (1999) and Worthington and Higgs (2003) for interesting developments in this area.

V Concluding Remarks

This paper investigates risk and return in the Australian art market during the period 1973–2003. The hedonic price method is used to construct a yearly price index using data on 37 605 paintings by 60 well-known artists sold at auction during this time. Over this period, the return on Australian art averaged 6.96 per cent with a standard deviation of 16.51 per cent. This is comparable risk and return to that found in other international art markets. Of course, the renowned artists used to construct this index inevitably involve bias towards higher-valued works, so the risk and returns may only be truly indicative of masterpieces, rather than artworks more generally.

The method employed in the paper also identifies factors associated with higher prices in the Australian art market. All other things being equal, works by McCubbin, Gascoigne, Thomas and Preston and artists deceased at the time of auction, larger sized works and those executed in oils or acrylic, and those auctioned by Sotheby's or Christies are associated with higher prices. Conversely, works by Arkley, Boyd (Jamie), Larter and Hodgkinson and artists living at the time of the auction, smaller works, etchings, crayon or charcoal works, along with those auctioned by Australian Art Auctions, James Lawson and Leonard Joel are associated with systematically lower prices.

There are many interesting opportunities to expand upon this work. One possibility is to extend the hedonic price index method and construct price indices for individual Australian artists and schools. This would permit the development of a capital asset pricing model in art along the lines of Locatelli Biey and Zanola (1999) or the construction of Markowitz efficient art portfolios in a manner similar to Worthington and Higgs (2004). Another would involve gathering additional information to be included in the hedonic pricing regression model. For example, the prices (and hence returns) on artists' work may also depend on the cumulative number of works auctioned, the age of the artist at the time of the auction, genres of work, interactions between medium and size and so on. Although

these impacts are proxied by the artist's name in the current analysis, a more defined specification would identify some determinants potentially obscured.

Yet another extension is to examine art markets along the lines of the market efficiency literature. One possibility is that auctioned artworks are subject to a 'masterpiece effect' whereby expensive paintings tend to underperform the market, which in turn could be the result of a winner's curse due to excessive bidding at auction. Another is the question whether art prices follow a random walk. Finally, the results of this analysis indicate that the value of sold works varies systematically by auction house, though it is not possible to identify the direction of the causal relationship. Future research could then aim to resolve the exogeneity problem, perhaps with a sub-sample time-series of works by a very prolific artist, such as Norman Lindsay.

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