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On the hedonic determinants of art photography prices

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Abstract

The economics of paintings and sculpture have extensively been analysed, but the literature records no application to photography. This article estimates a hedonic model to relate the prices of auctioned photographs to their attributes. Our model explains 53 percent of variations across photographs' values, emphasising the importance of sale location, career period of the photographer, and the presence of a pre-sale estimate. There is insufficient evidence whether photographs can be a valuable financial asset.

1. Introduction

The literature agrees on the importance of hedonics in explaining artworks' prices. The literature also concludes that fine art objects can contribute to portfolio diversification. As this, the demand for artworks has considerably increased over the last three decades. The global public auction fine art market reported a total revenue of $6.4bn in 2006, compared to less than $3bn during the period 1999-2003, and a mere $10mn in 1975. Paintings (75%) represent the largest category sold, followed by watercolours (11%), sculpture (8%) and photography with less than 4% (artprice, 2002, 2003, 2004, 2005, 2006).

The market for art photography is characterised by its small size and strong locational concentration. The limited size of the photography market can be justified by its late installation, as it took more than a century for the market to recognise the monetary value of photographs. *Sotheby's* was the first room to auction photographs in 1971 in London and in 1975 in New York. In addition, it was not until the 1920s that photography was acknowledged as a fine art medium. For decades, many paintings have been traded for exorbitant sums; whereas the first photograph to cross $1mn was in 2005, when *Richard Prince's 'Untitled (Cowboy)'* sold for $1.25m at *Christies*, almost twice the previous record ($600,000) set in 2001. The current most expensive photograph is *Steichen's, 'The Pond-*Moonlight', sold for $2.9mn at Sotheby's in 2006.

Second, the photography market is governed by locational concentration. The auctioneers, *Sotheby's* and *Christies,* account for more than 75% of total sales. Both have the reputation of attracting authentic lots and affluent buyers. At another level, the cities of New York and London are the most preferred locations where photographs are auctioned because of their international prestige and wealth.

In the literature, the price hedonics of paintings are thoroughly examined. In the present article, we investigate the role of the hedonics in affecting photographic prints' price. Earlier studies on similar issue include Pompe (1996), who devoted a whole paper on photography but the purpose of this study was to examine the return characteristics of photographs. Pompe (1996) applied the repeat-sale method to a sample of 1,192 transactions to calculate rate of returns for the years from 1980 to 1992. The results recognised that photographs as an investment may offer attractive return values (30% average annual return), but the high risk and increasing prices and returns on alternative collectibles and assets may offset these opportunities. However, Pompe (1996) suggested that photography presents an opportunity for small investors, to construct an affordable art investment portfolio.

This article intends to explain the prices of auctioned photographic prints using the hedonic analysis. This method presumes the presence of a relationship between prices of artworks and their corresponding attributes. An examination of photography prices generates valuable insights into their market's valuation. Section II presents our empirical model. Section III describes data and the variables. Section IV presents the results. Section V concludes.

2. Methodology: Hedonic regression method

The hedonic model assumes that prices of differentiated products can be explained by a vector of exclusive characteristics. In hedonic equation, the natural logarithm of prices is

held as the dependent variable, whereas a number of continuous and dummy variables derived from the items attributes are held as independent variables. For artworks, such as photographs, the set of independent variables may capture personal, physical, transaction and time of sale information. The hedonic equation is the follows:

$$\ln(p_{t,i}) = \alpha_0 + \sum_{t=1}^{nt} \theta_t T_{,i} + \sum_{k=1}^{k} \beta_k X_{kt,i} + \varepsilon_i$$

Where $\ln(p_{ti})$ is price of photograph i expressed in natural logarithm; α_0 is a constant term, T_i is a vector of time dummy variables for time of sale of photograph i with a value of 1 in quarter period t and 0 otherwise, θ_t is the regression coefficient for time dummies, $X_{k,i}$ is a vector of continuous and dummy variables, β_k is the regression coefficients on the vector of explanatory variables $X_{k,i}$. ε_{it} is an error term.

3. Data and variables selected

Data employed in this article consist of price information drawn from the Hislop's CD-ROM 2004. Our sample comprises 11,174 photograph transactions for the main period from 1995 to March 2004. Unfortunately, data for the years of 1997 and 1998 and for the first three quarters of 1999 are not available on the Hislop's 2004 edition. Our criteria to select variables are the availability of information, relevance in the literature and the presence of multicollinearity.

The preliminary analysis of data indicated the presence of potentially harmful multicollinearity emphasised by a three-dimensional and strong correlation between rooms, cities and countries of auction. At the country level, the US dominate with 64% of total sale, followed by the UK (16%), and France (10%); at the city level, New York accounts for more than 60% of total observations followed by London (15%) and Paris (10%); at the auctioneer level, Christies (35%) and Sotheby's (27%) are the most represented, followed by Phillips (9%), and the majority of their transactions took place in New York and London. Consequently, we include five dummy variables to represent location of auction; which are Christies-London, Christies-New York, Sotheby's-London, Sotheby's-New York and Phillips.

Other information captured by our model includes working period (dummy variables for 19th Century and 20th Century categories, whereas 19/20th Century period is held as the standard period), a dummy variable controlling for the presence of pre-sale estimates, and two size variables (surface area and surface area-squared). Eighteen time dummy variables that control for quarterly periods from Dec-99 to Mar-04 are also included. The coefficients on time variables help construct a price index and derive its returns. Dummy variables are specified for selected artists to estimate premiums differentials relative to other names. A total of 150 photographers among which two *duos*; are included in our model. The coefficients on name variables allow for ranking and identifying the most expensive photographers in the sample. Table 1 displays summary statistics for our sample's photograph accordingly with selected hedonic attributes.

4. Results and Analysis

4.1 Model analysis

In the preliminary analysis, eight several specifications were estimated using Equation 1 with different combinations of variables included in the X_i vector. Consequently,

statistically insignificant variables, such as the nationality of photographers, were omitted. The computed coefficients and t-statistic for our parsimonious model are presented in Table 2.

Our estimated model and coefficients are found statistically significant at the 1% critical level. The *adj-R²* indicates that our model captures 53% of the price differentials among photographs. We tested multicollinearity by running Inflation Variance Factor (VIF). Harmful multicollinearity is present when VIF is significantly greater than 10. Our model's VIF is 1.2 and none of the variables' VIFs exceeds the critical value of 10.

First, the coefficient on the 19th Century category is found positive, whereas the coefficient on the 20th Century category is found negative. The works by 19th Century photographers are 24% more expensive than the works by the standard category of 19/20th Century photographers. In contrast, prints produced by 20th Century photographers fetched prices 18% lower than the works by 19/20th Century photographers. Therefore, the works by 19th Century photographers, who produced vintage photographs, were auctioned at prices 40% higher than the works made by 20th Century photographers, who used modern and contemporary techniques.

The coefficients on the auctioneers' variables show that sales at Christies and Sotheby's held in New York; increased the standard price of photographs by 83% and 69%, respectively. Sales at Christies and Sotheby's held in London increased the price of standard photographs by 36% and 46%, respectively. These findings suggest that *New York* and *Christies* exhibit higher premiums than other locations. Traditionally, New York (and London) attracts large numbers of affluent international collectors and investors, whereas Christies (and Sotheby's) auctions prints that exhibit recognised provenance and authenticity, among other.

The coefficient on the pre-sale estimate variable is found positive, indicating that pre-valued works tend to sell at prices 20% higher than those sold without a pre-estimate. The pre-sale estimate value might indicate the buyer's expected hammer price and the seller's reservation price. Finally, the coefficients on the size variables have the expected signs. Larger prints are generally perceived to have higher prices, but the valuation of larger photographs does not increase proportionately with their surface area. However, because the coefficients are of negligible magnitude, photographs' values are insensitive to variations in size.

4.2   Price Index and photograph returns

Table 3 provides our quarterly price index and returns for the period from Sep-1999 to Mar-2004. Following Higgs and Worthington (2005), the price index for our collectibles is calculated as $100e^{\beta t}$ set relative to a given base period value (the quarter of Sep to Dec-1999=100), whereas returns are computed as $ln(p_t/p_{t-1})*100$. We also include quarterly returns for S&P500 index and the three month treasury bills rates over the corresponding period to allow for comparison.

The quarterly mean return for our photograph price index is 1.97% with a standard deviation of 31.74%. The quarterly mean returns for the S&P500 index and risk-free rates (the US 3-month treasury bills) were -1.36% and 2.74% with standard deviations 7.24% and 1.99%, respectively. The correlation matrix shows a positive but weak relationship between photograph returns and S&P500 index returns (26.34%), but an inverse relationship with risk-free rates (-11.58%). The estimated photography index

outperformed the stock market index, but risk-free rates remained relatively higher. In addition, the return standard deviation estimates show that purchasing photographs is more risky than other assets. There is insufficient evidence whether the inclusion of photographs can have a positive impact on a diversified investment portfolio.

4.3   Photographers' ranking

Our results show that the most expensive photographer is *Barney Matthew*, whose photographs were sold six times greater than the standard photographs. The works by the duo "*Gilbert and George*" fetched prices nearly five times higher than the standard photograph. The list of ten most expensive photographers includes *Outerbridge, Moholynagy, Modotti Tina, Sherman Cindy, Strand Paul, Gonzal ezto, Gray Gustav, and Girault,* respectively.

5. Conclusion

This article applied the hedonic methodology with transaction-based data to investigate principal factors influencing photographs' prices auctioned worldwide. The analysis show that attributes associated with working period of the photographer, location of auction, and the presence of a pre-sale estimate have a statistically significant influence on photographs prices. The analysis found that the works produced by 19th Century photographers exhibit higher premiums than the works by 20th Century photographers. Photographs sold in New York and Christies attracted higher values than in other locations. Size effect can be described as neutral. Finally, there is insufficient evidence whether photographs can be a valuable investment option compared to other assets, in accordance with the results of Pompe (1996).

6. References

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7. Appendix: Tables

Table 1: Selected descriptive statistics

Definition	Mean	St. Dev	Minimum	Maximum	Skewness	Kurtosis
All sample	14,438	34,737	698	810,000	8.52	109.89
Century						
19/20C	10,813	32,910	750	624,800	13.35	223.01
19C	20,424	52,428	750	810,000	8.17	89.71
20C	13,941	31,459	698	550,000	7.14	72.57
Country of sale						
France	12,301	27,719	698	388,075	7.21	69.21
UK	21,820	52,705	750	810,000	7.61	79.83
USA	14,252	32,220	800	550,000	7.29	75.42
City of auction						
London	20,377	47,037	750	810,000	7.68	87.32
New York	14,900	33,137	800	550,000	7.09	71.18
Paris	12,890	28,631	698	388,075	7.04	65.39
House of auction						
Christies	16,745	38,328	750	810,000	7.65	93.99
Phillips	19,886	41,664	1,000	550,000	6.56	56.46
Sotheby's	17,979	35,741	794	575,400	6.46	59.67
Pre-sale estimates						
Presence of a pre-sale estimate	5,347	13,350	698	340,000	11.97	207.18
No presence of pre-sale estimate	19,475	41,298	780	810,000	7.34	80.1

Table 2: results for our hedonic variables

Variables	Coefficients	t-statistic
Constant	7.3855	167.13
19th century	0.2146	4.04
20th century	-0.1878	-4.17
Pre-sale estimates	0.2182	7.65
Christies New York	0.6284	27.53
Christies London	0.3346	10.16
Sotheby's New York	0.5540	22.58
Sotheby's London	0.4099	10.61
Phillips	0.4260	12.74
Size (cm)	0.0003	26.70
Size-squared (cm^2)	0.0001	-17.55

F-statistic (182, 10991) = 70.90 (p-value = 0.00), Root MSR = 0.79

Table 3: Price indices and related returns

Month	Photograph price index	S&P500 Index	Returns on photograph index	S&P500 returns	3 month treasury bil
Dec-99	100.00	1,394.46	-	-	-
Mar-00	93.81	1,452.43	-6.39	4.07	5.69
Jun-00	88.83	1,430.83	-5.46	-1.50	5.69
Sep-00	110.79	1,429.40	22.09	-0.10	6
Dec-00	98.54	1,366.01	-11.72	-4.54	5.77
Mar-01	63.69	1,249.46	-43.64	-8.92	4.42
Jun-01	108.91	1,211.23	53.65	-3.11	3.49
Sep-01	102.93	1,059.78	-5.65	-13.36	2.64
Dec-01	103.95	1,130.20	0.98	6.43	1.69
Mar-02	130.77	1,076.92	22.96	-4.83	1.79
Jun-02	91.02	911.62	-36.24	-16.66	1.7
Sep-02	66.94	885.76	-30.73	-2.88	1.63
Dec-02	93.28	855.70	33.17	-3.45	1.19
Mar-03	59.42	916.92	-45.09	6.91	1.13
Jun-03	100.68	990.31	52.72	7.70	0.92
Sep-03	80.83	1,050.71	-21.95	5.92	0.94
Dec-03	107.55	1,131.13	28.56	7.38	0.9
Mar-04	139.69	1,107.30	26.15	-2.13	0.94
Mean	-	-	1.97	-1.36	2.74
Standard deviation	-	-	31.75	7.24	1.99

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