WHAT DETERMINES CÉZANNE'S ART PRICING?
A HEDONIC REGRESSION METHOD

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Abstract

The contribution of this paper is empirical. We employed the hedonic regression method to compile a price index for Cézanne's artworks and examine their financial properties. This paper reported the following findings: i) oil prints were more expensive than prints on paper, ii) there was a statistically significant evidence in favour of the presence of the Law of One Price for Cézanne's artworks, iii) the dimensions of the sample's prints were found to influence hammer prices, iv) paintings made during the artist's later career were traded at higher premiums than prints made in the early stages of his career, and finally v) it is inconclusive whether Cézanne's prints could provide strong benefits to a diversified portfolio.

Keywords: cézanne, hedonic regression method, CAPM

1. INTRODUCTION

In 2006, a number of cultural events were organised to commemorate the centenary of the death of the prominent French artist Paul Cézanne (1839-1906). This painter is considered to be the *father of the post-impressionism* and the encourager of *cubism* in art; and his work sells at millions of US dollars in various auction houses, such as Sotheby's and Christie's (see Table no. *1*). Chanel, Gérard-Varet and Ginsburgh (1996) found Cézanne's prints to be the most valuable in the paintings market, followed by van Gogh and Renoir, and even well ahead of Picasso, who ranked 12th in their sample. In May 1993, Cézanne's (1839-1906) oeuvre *Nature morte-les grosses pommes* (1890) was sold for US$26m at Sotheby's New York, making it the highest price paid for Cézanne's work by then. Six years later, in May 1999, Cézanne's *Rideau, cruchon et compotier* (1894) fetched a record price tag of US$60.5m (premium included), at Sotheby's New York. This particular sale placed this

painting among the ten most expensive paintings ever recorded in the art market. Between 1989 and 2003, sixteen paintings by Cézanne were sold at an individual price equal or greater than US$10m, with a total turnover of US$310m (see Table no. *1*).

Nevertheless, a short time after the sale of *Rideau, cruchon et compotier*, it was re-sold, but with a loss of 10 per cent (the Guardian, 1999). This particular incident might generate some doubt about the overall pricing and financial characteristics of Cézanne's work, compared to other asset classes. It was reported that at the time of the re-selling, Wall Street experienced an increase of 25 per cent (the Guardian, 1999). Although this increase could explain the re-selling of the painting, it seems uncertain whether Cézanne's art generally underperformed Wall Street. Within this framework, the compilation of a price index for this prominent artist's prints appears to be consequential. The construction of a price index helps observe the general time movements of Cézanne's art prices and examine its return and risk properties. Generally, price indices for art objects are believed to act as information carrier with which we one can recognise the critical moments that occurred in the art market. In this sense, the main causes that commanded the changes in art prices can be identified, and therefore, the potential interrelations between art and other asset classes can be perspicuous. For example, Goetzmann (1993), Pesando (1993) and Mei and Moses (2002) measured art return and risk characteristics and compared them to traditional asset classes. The main purpose of these studies was to establish whether investing in art can provide some benefits to a diversified portfolio.

In the literature, Cézanne's works were examined at a group level, included either in the Impressionists category (Ashenfelter and Graddy, 2002) or French Impressionists category (Higgs and Worthington, 2004). To the knowledge of the authors, no price index has been suggested for Cézanne artworks, compared to the numerous studies on other artists such as Picasso (Czujack, 1996; Pesando and Shum, 1999; Locatelli-Biey and Zanola, 2005) and Rembrandt (Lazzaro, 2006). Contrary to this trend, this paper is devoted to the calculation of a price index for Cézanne's art using the hedonic regression method. We intend to observe the general movements in Cézanne's art prices, examine the annual returns and compare these to other traditional assets such as gold, stocks and bonds. Our price data are drawn from auctions held worldwide during the period from 1970 to early 2004.

The reminder of this paper is organised as follows. In the next section, we describe the data used in this study, the hedonic methodology and the CAPM framework. Subsequently the results from the previous section will be analysed. The final section includes concluding remarks.

2. DATA AND METHODOLOGY: THE HEDONIC MODEL

Data

Data used in this paper are drawn from the Hislop's Art Sales Index CD ROM 2004 database, which contains 2.8 million sales for various collectibles. The UK-based Hislop, labels auctioned art objects into six categories; oil papers, works on paper, prints, photographs, sculpture and miniature, whereas artists are grouped into five cohorts: Old Masters, 18/19th Century, 19th Century, 19/20th Century and 20th Century. In addition to the type of work and periodic identity, the Hislop's database contains further information with regards to the artists, work and sale. First, personal information include artist name, nationality and years of birth and death; second, work information contain object title, year of making, size

dimension (height, width, and width for the case sculpture); and finally, sale information comprise selling price, (in US dollar and Sterling), salesroom, city and country of sale, and date of sale, among others.

The dataset for the current study consists of 930 sales that occurred over the period from January 1970 to December 2003. These sales took place in about 90 auction houses scattered around 40 cities in 13 countries, all located in Western Europe and the US. Our annual frequency starts from January, the 1st and December, the 31st of the same year. For example, sales between January, the 1st and December, the 31st, 1970 are recorded in the time period of 1970; sales between January, the 1st and December, the 31st, 1971 are included in the time period of 1971, and so on. Table no. *2* displays the number of Cézanne's sales in our dataset categorised according to the type of painting and location of transaction. The majority of the sales occurred at Sotheby's and Christies in the UK and the US. Table no. *2* also shows that the sample's monthly sales were highly concentrated in May/June with about 40 per cent of the total number of sales, and in November/December with 32 per cent of the total number of sales.

Selected summary statistics of Cézanne's work prices from January 1970 to March 2004 are provided in Table no. *3*. Over this period, the average price paid for a Cézanne's print was about US$700,000 with a standard deviation of US$3m. Table no. *3* shows that oil paintings were, on average, twenty-five times as expensive as works on paper. With regards to place of sale, prints traded at Sotheby's were about one and a half times more valuable that those traded at Christie's. In addition, prints sold in New York, were two and a half times and about fourteen times more expensive than those sold in London and Paris, respectively.

In addition, Table no. *1* reports the sixteen most expensive Cézanne's art ever sold in the international fine art market. All paintings are made with the medium of oil, and all were auctioned at prices greater or equal to US$10m. Table no. *1* shows that eight out of the sixteen paintings were auctioned at Sotheby's with a total of US$168.5m (or 54 per cent of total turnover), compared to US$90m for Christie's (29 per cent of total turnover) and US$50m for Phillips New York (16 per cent of total turnover). In addition, thirteen out the sixteen paintings were sold in New York with a total of US$250m (or 80 per cent of total proceeds), compared to three to London and none to Paris. Overall, the US and the UK, represented by New York and London, dominate the international fine art market, with 45 per cent and 25 per cent of total auctioned sales turnover, respectively (ArtPrice, 2005, p 6-7). The US has led the international fine art market for more than 20 years, and in the mid-1990s, at its peak, the US hosted nearly 70 per cent of the global fine art sales (www.artmarketinsight.com/en/art_article).

Hedonic regression method

The literature has used two transaction-based regression methods to propose price indices for artworks: the repeat sales method and the hedonic method. In the repeat sales method, the price index is calculated only for those objects that were sold at least twice, and therefore, this approach requires a large number of observations in the examined dataset. In contrast, the hedonic method uses all available observations regardless of the sale frequency. In this paper, we use the hedonic methodology because of the diminutive number of repeat sale observations in our sample. The hedonic regression method was introduced by Haas (1922) who computed a price index for land, and later used by Count (1939) for auto-

mobiles (Fase, 2001; Mauer, Pitzer and Sabastian, 2004). For artworks, this method was used by, among others, Frey and Pommerhene (1989), Buelens and Ginsburgh (1993), de la Barr, Docclo and Ginsburgh (1994), Chanel, Gérard-Varet and Ginsburgh (1996), Forsund and Zanola (2001), Locatelli-Biey and Zanola (2002), Rengers and Velnthuis (2002), Ronneboog and van Houtte (2002), Hodgson and Vorkink (2003), and Worthington and Higgs (2005 and 2006).

The hedonic method lies on the principal thought that every art object is unique, heterogeneous and has a set of idiosyncratics that make it exclusive. These characteristics are perceived to play an important role in process of the object's valuation (Hodgson and Vorkink, 2003). The exclusive qualities of paintings are widely recognised by art experts. For example, when Gérôme's orientalist painting *La Grande Piscine* sold for about £1.9m in 2004, Sotheby's, in a press release, wrote that "*La Grande Piscine has all the qualities the market tends to value most: illustrious provenance, fine condition and desirable subject matter*" (Sotheby's, Services and Information, Investor Relations, at www.shareholder.com/bid/news/20040615-137107.cfm). Mathematically, the hedonic regression method collects price information of individual transactions regresses these on a set of dummy variables linked to the time of sale and other explanatory variables related to the hedonic idiosyncratics of the paintings. The coefficients associated with time dummies variables are used to compile a price index that measures time variations in the general market for artworks (Fase, 2001; Ginsburgh, Mei and Moses, 2005). The equation of the hedonic regression method can be formulated as follows:

$$\text{Ln}(p_{it}) = \gamma + \sum_{t}^{T} \beta_t X_{it} + \sum_{t}^{T,n} \alpha Z_{it} + \varepsilon_i \, , \, (i=1,\dots,n) \text{ and } (t=1,\dots,T) \quad (1)$$

where Ln (p_{it}) is the logarithm price of painting i sold at time point t, where $i = 1, \dots, n$, and $t = 1, \dots, T$. n is the number of paintings included in the sample and T is the number of time period investigated in the sample. X_{it} is a vector time dummy variables that carry the value of one for a particular point of time t (time of transaction) for painting i, and equal to zero otherwise, where $t = 1, \dots, T$. Z_{it} is a vector of hedonic explanatory variables that quantify the exclusive idiosyncratics of a painting i, and ε_i is a disturbance term independent of the logged prices variable. The parameters of the vector $\{\beta_t\}^T_{t=1}$, associated with the vector of time dummy variables X_{it}, will form the price index, whereas α is the vector of coefficients associated with the hedonic variables, and measures the changes in switching from 1 to 0.

In our study, the idiosyncratic characteristics are selected subject to availability and according to the properties of our data as illustrated in Table no. *2* and Figure no. **1**. Our explanatory variables are: i) year time: binary variables in time *t*, with *t* =1970,…,T, where T= 2004, ii) type of painting: dummy variables for oil paintings and works on paper, iii) houses of auction: dummy variables for Sotheby's and Christie's, iv) city of sales: binary variables for Paris, New York and London, v) country of sale: dummy variables for France, USA and UK, vi) size dimension: continuous variables for height, width and surface of the print, all measured in meter, but surface in meter squared, and vii) working period: dummy variables for the sub-period until 1870, between 1870 and 1880, between 1880 and 1890 and from 1890 to 1906.

3. CÉZANNE'S PRINTS AS AN INVESTMENT: RETURNS, RISK AND CAPM

The compilation of price indices for art objects provides useful information about the behaviour of art returns. Investors in the art market are concerned with the construction of a diversified portfolio that comprises artworks and other asset classes such as stocks and bonds, or a portfolio that exclusively includes art objects of different segments. Consequently, the inclusion of art objects in a diversified portfolio is regarded as a medium of holding wealth, maximising return and minimising associated risk. Art literature has attempted to establish whether including art in a diversified portfolio is beneficial to an investor.

Ashenfelter and Graddy (2002) state that the analysis of the financial characteristics of art is carried by examining its performance trajectory and the quality of the relationship between its returns and returns of other asset classes, using simple correlation or CAMP framework. Mei and Moses (2002) estimated a CAPM equation to measure the relations between returns from art indices and those of bonds and stock. Hodgson and Vorkink (2003) used CAPM to compare the investment properties of Canadian art with those of Canadian stocks government and bonds. In this paper, we use the Standard and Poors 500 index (S&P500), US 3 month Treasury bill rates and US 10 Treasury bond rates to construct our CAPM equations. Art returns are computed as $R_t = Ln(P_t/P_{t+1})$. The excepted rerun on art object i in period t, denoted as $R_{i,t}$, in excess of the return on free-risk security, denoted as $R_{f,t}$, can be viewed as a linear function of the expected excess return on the market portfolio in period t, denoted as $R_{M,t}$. This relationship can be presented in the following equation:

$$E_t [R_{i,t}] - R_{f,t} = \beta_i * E_t [R_{M,t} - R_{f,t}] \quad (2)$$

where $R_{i,t}$ is the return on art asset i, or art portfolio or index, $R_{M,t}$ is the return in market portfolio in period t, $R_{f,t}$, is the risk-free rate for index, and β_i is the covariance between $R_{M,t}$ and $R_{f,t}$ divided by the covariance of returns of the market $R_{M,t}$. Equation (2) tests how the variations in the stock market returns led to variations in the art market. Following Pesando (1993), the relationship between the components of the CAPM function can be captured in the following OLS equation:

$$R_{i,t} = \alpha + \beta R_{M,t} + \theta_i \quad (3)$$

where $R_{i,t}$ is the excess return on art price index in period t and is calculated as the return on the art index minus the return in a free-risk security $R_{f,t}$, $R_{M,t}$ is the return in market index, α is a constant, β is a parameter and θ_i is a disturbance term. Equation (3) indicates that β measures how much of the of the return of the art category of market investigated is prices as a systematic risk, that is, it measure the portions of returns that are subject to market risk exposure, while the intercept α measures the portions of returns that are not subject to market risk exposure.

4. RESULTS AND ANALYSIS

Price index and hedonic characteristics

The estimated coefficients of our OLS regression model are presented in Table no. 4. The values of the annual hedonic regression price index and associated returns reported in Table no. 4 are estimated according to equation 1. The R^2 and adjusted R^2 for the logged price regression are equal to 0.6731 and 0.6751, respectively, associated with F-statistic of 38.5, which is found to be statistically significant at the 1 per cent critical level. Figure no. 2 illustrates the price index for Cézanne's prints in comparison to the S&P500 index. Over the sample's period, the price index of Cézanne's prints developed in two different patterns in comparison to the S&P500 index. From 1973 to 1994, Cézanne's prints' index lay above the S&P500 index, but from 1994 to 2003, Cézanne's artworks price index moved beneath the S&P500. Table no. 5 displays selected price summary statistics for Cézanne's artworks, which can explain the changes in the price index. Figure no. 2 generates the following observations:

i) 1970-1986: this sub-period was characterised by a persistent volatility, possibly due to the small number of sale observations, especially in 1973 (see Table no. 5). Three major decreases occurred during this sub-period: in 1973-76, 1980-82 and 1983-86, and these decreases seem to be driven by the decrease in the average price for Cezanne's prints, and also by the small number of sale (see Table no. 5).

ii) 1986-1988: this sub-period witnessed a high increase of about 3.5 times between 1986 and 1988. In 1987-89, Cézanne's artworks price index evolved higher than the S&P500 index. In the late 1980s, the art index for Cézannes peaked at above 2,000 per cent, and the gap between this index and the S&P500 calumniated in 1986-94. Table no. 5 shows that in 1988, the average price paid for a Cézanne's work was US$2.34m, the highest in the whole period. In 1988, only 14 paintings in our sample were sold, six of which sold for prices higher than US$1m, with a maximum value of US$8.4m (*La cote du Galet àPontoise*).

iii) 1989-1994: this sub-period experienced a decline in Cézanne's prints price index to from 2,000 per cent in 1989 to a level of less than 500 per cent in 1995. Table no. 5 shows that in 1994-1995, the average price for Cézanne work was less than US$200,000 compared to US$1.25m in 1992 and US$1.99m in 1993. This may be explained by the fact that only few oil paintings were traded in 1994-95, so the sales were dominated by prints and works on paper.

vi) 1995-2002: over this sub-period, the price index of Cézanne's art developed beneath the S&P500 index, but both moved at the same direction until. Over this period, Cézanne's index increased from about 100 per cent to more than 500 per cent in 2001.

Table no. 2 shows that eleven of the sixteen most expensive paintings sold at a price higher than US$10m occurred during this sub-period. Table no. 5 shows that in 2003, there were 82 of Cezanne's paintings sold during this year with an average price US$364,936. This low average price compared to the year from 1995-2003, may indicate that the quality of work auctioned has not attracted high values and therefore, previous buyers of Cézanne's art have chosen to wait for a while before re-selling the paintings, because art is a long-run investment, or their consumption of their products is still ongoing.

Table no. 4 displays the coefficients associated with the type of paintings selected in this study, which are oil and paper, compared to the third type, i.e., prints. Both coefficients

are found to be statistically positive and significant at the 1 per cent critical level. The coefficient associated with the medium of oil, 2.96 is found to be higher than that of paper, 1.17. This indicates that oil paintings and works on paper are 1,921 per cent and 322 per cent, respectively, more expensive than other prints. This implies that Cézanne's oil paintings were approximately six times as expensive as his works on paper. We test the null hypothesis that the coefficients associated with oil paintings and works on paper are equal. Provided that the value of the F-statistic is 270.20 with p-value of 0.00, we reject this null hypothesis in favour of the alternative, suggesting that the pricing differences between oil paintings and works on paper are statistically significant at the 1 per cent critical level. This result is not surprising when we refer to Table no. 1, which shows that the most expensive work painted by Cézanne are oil paintings. Czujack (1997) found similar results for Picasso's oil paintings. Higgs and Worthington (2006) state that oil paintings outlive works on paper, and are resistant to various enfeebling factors such as natural light and, are therefore more likely to sell at higher premiums.

Table no. 4 shows the results of the hedonic regression for the location of auction where Cézanne's work was sold. The set of dummy variables selected to identify the sale location of include houses, city and country of sale. The inclusion of these dummy variables tests for the presence or violation of the "Law of One Price" effects. This law states that, in the absence of transaction costs, artworks of similar characteristics should sell at prices with no significant differences (Higgs and Worthington, 2006). Hodgson and Vorkink (2003) examine a sample of paintings that were sold at 36 auction houses. Our findings show a strong association between the house of auction and the selling price. Pesando (1993) and de la Barre *et al.* (1994) found that artworks auctioned at Sotheby's and Christie's sold at higher prices than elsewhere. Pesando (1993) found that, over the sub-period 1989-1992, modern prints' prices were 7 per cent and 11 per cent higher in New York than in London and Europe, respectively.

First, the coefficient associated with Christie's, 0.4421 is found to be significant at the 5 per cent statistical level, while the coefficient associated with Sotheby's, 0.3576, is found insignificant at the 5 per cent critical level. Prints sold at Christie's and Sotheby's worldwide fetched prices that are 155.60 per cent 142.22 per cent, respectively, higher that paintings sold elsewhere. Therefore, Christie's exhibited a slight premium at a magnitude of 10 per cent over Sotheby's. We test for the null hypothesis that the estimated coefficient for Christie's is equal to Sotheby's. We cannot reject this null hypothesis (F-statistic: 0.50, p-value: 0.4783), suggesting that both places of auction equally contribute to the final formation of the hammer price. Our finding is not unanticipated. Both Christie's and Sotheby's have outstanding reputation and undisputed market power, which attract high quality artworks sought by wealthy collectors, dealers and investors. Therefore, the law of One Price is not violated across houses of auction.

Second, Table no. 4 shows the coefficients associated with our selected variables of city of sale. The coefficient associated with New York, 2.1234, is found greater than those associated with London, 1.1666, and Paris, 1.0831. The coefficients for New York and Paris are found to be significant at the 1 per cent critical level, while London's coefficient is significant at the 10 per cent critical level. These results indicate that Cézanne's art sold in New York, London and Paris fetched prices higher than other cities by 835.95, 321.11 and 295.38 per cent, respectively, than those sold elsewhere. This implies that Cézanne's art traded in New York were more than two times as expensive as those paintings sold in London and Paris. We test the null hypothesis that the coefficients associated with Paris,

London and New York and equal. The F-statistic is found 1.48 with p-value of 22.81, suggesting that the pricing differences across these locations are found to be not statistically significant at the 5 per cent critical level. Thus, the Law of One Price seems to be present across cities of sale.

Third, Table no. 4 shows that the coefficients associated with our selected variables of country of sale are all negative and only France and US coefficients are significant at the 1 per cent critical level. The magnitude of these coefficients suggests that Cézanne's work sold in France, UK and US are, respectively, 65, 60 and 75 per cent lower than artworks sold in other countries. This suggests that, on average, Cézanne's prints sold across the UK were about two times as expensive as those sold in France and the US. The null hypothesis that the coefficients associated with these three dummy variables are equal is tested and cannot be rejected (F-statistic 0.61, p-value: 0.5430). Therefore, we may suggest that the Cézanne's artworks prices are not statistically different across countries of sale. This is another evidence that for the presence of the Law of One price for Cézanne's art.

Table no. 4 shows the coefficients associated with size dimension variables, which are height, width and surface, and all are found to be significant at the 1 per cent critical level. While the coefficients associated with height and width are found to be positive and carry the relatively same magnitude, 0.04, the coefficient associated with surface is found to be closer to zero with a negative sign. Our results indicate that prices tend to increase with increasing height or width at the level of 4 per cent for every additional cm. Albeit not significant, the negative sign of the coefficient varied by the variable of surface indicates that the larger the surface the lower the selling price. This suggests that prices tended to increase with height and width, but when it reached a bigger size, interest in this painting tended to decrease. Fine art collectors might have preferred reasonably-sized artworks that can be easily transported and hung on the walls. In most cases, only museums and institutional investors purchase large-sized artworks.

Finally, we divide the artistic career of Cézanne's into four time sub-periods; 1839-70, 1870-80, 1880-90, and 1890-1906. We seek to investigate whether these working sub-periods may show some career segmentation, and also whether the participants in the fine market place value on art Cézanne based on his career development. Overall, Table no. 4 shows that the paintings that were made at later phases of Cézanne's career are the most valuable compared to those made earlier. When we test for the null hypothesis that all the working sub-periods are equal, the generated F-statistic is found to be 7.13, and this is significant at the 1 per cent critical level. Accordingly, we reject the null hypothesis that the coefficients associated with the four-sub-periods are equal. This finding provides evidence that the most expensive of Cézanne's work was made during his later years. Table no, 1 shows that the most expensive of Cézanne's prints were made during the last twenty-five years of his life. In 1886, Cézanne became financially secure as he inherited wealth from his rich father. Since, he devoted his time to paintings, principally centred on portraits of his wife, *still lifes* and pictorial landscapes of Province, such *Montagne Ste Victoire* (Chilvers, 2005, p117). In 1895, Cézanne began to gain some degree of reputation when a one-man show was devoted for his art in Paris, and in 1904, an exclusive exhibition was organised to him by the *Salon d'Automne*. By then, Cézanne was called the "*Sage*" and Henri Matisse (1869-1954) bought one of his pictures (Chilvers, 2005, p118).

5. RETURNS, RISK AND CAPM

Table no. 6 shows the summary statistics for Cézanne's art returns and selected financial assets returns over the period from 1970 to 2003. The mean nominal return on the Cézanne's artwork portfolio is 6.26 per cent. This is lower than the mean returns on S&P500 index (7.55 per cent), and long-term bonds (7.70 percent). Nevertheless, Cézanne's art, on average, yielded slightly higher returns than gold (5.93 per cent) and Treasury bills (6.16 per cent). The standard deviation of Cézanne's artworks' returns is found to be 68.87 per cent, compared to 16.73 per cent for S&P500 return, 19.39 per cent for gold, 3.01 per cent for US 3 month Treasury bills, and 2.43 per cent for US 10 year Treasury bond rates. Therefore, the prints portfolio comprised of Cézanne's oeuvres yields slightly lower rates of returns that the S&P500 index, with a degree of risk that is higher than the risk of stocks, gold and risk-free securities.

Art could secure comfortable returns and reduce overall risk if it was included into a portfolio along traditional financial assets (Pesando and Shum, 1999). The investigation of this can be captured by measuring the correlation strength between prints' returns and returns from other asset classes. Table no. 7 shows that the correlation matrix between mean nominal returns from Cézanne's artworks with S&P500 returns and returns from gold are 1.35 and 18.02 per cent respectively, with a negative sign. The correlation estimates between return rates of Cézanne's artworks and US Treasury bonds and rates are found to be 3.08 and 6.27 per cent, respectively, but with a positive sign. These estimates show that the correlation between Cézanne's returns and those from stock, commodities and risk-free securities is weak, and therefore, portfolio diversification may seem achievable.

The weakly-negative correlation estimate found between art and equity returns may support the presence of a set of benefits when we include Cézannes' artworks into a diversified portfolio. However, the lower level of Cézanne's returns associated with higher risk in comparison to conventional financial assets as reported in Table no. 3, provides less support for the inclusion of Cézanne's art in an investment portfolio that also contains conventional financial assets. Our result is similar to Worthington and Higgs (2003), who found that returns from art objects are lower than those from financial assets, and therefore investing in Cézanne works provides less returns associated with higher risk compared to other assets classes. Art investments underperform equity markets investment due to higher risk and owing to its high transaction costs, resale right and insurance premia (Worthington and Higgs, 2003).

The general premise of CAPM is that investors are compensated only for bearing non-diversifiable or systematic risk; that is, the risk that remains when an asset is held in a widely diversified or market portfolio (Pesando and Shum, 1999). We estimate three specifications for the art returns under the framework of the CAPM model. The results for the three specifications are reported in Table no. 8. Specification 1 reports the results for art nominal return against nominal returns for the S&P500 index; specification 2 reports the results the result for both indexes adjusted to the US Treasury 10 year bond rates; and specification 3 presents the results for both indexes adjusted to the US Treasury 3 month bill rates. Overall, for the three estimated equations, we find that the portfolio has a relatively low systematic risk. The β estimate for nominal and risk-adjusted excess return is found negative and ranges between 0.05 and 0.08 for all the three specifications. Only in specification 1 and specification 2 the estimates of β are statistically significant at the 10 critical level. The β values in these two specifications are found 5.55 and 5.75 per cent, respective-

ly. These values imply that Cézanne's art may provide diversification benefits to a diversified portfolio. For comparison, Hodgson and Vorkink (2003) tested the returns derived from hedonic Canadian art index using CAPM analysis, which includes Canadian financial indices. The estimated β was found to be 35.9 per cent for annual data, indicating that art has less systematic risk than equities. Therefore, Canadian paintings can provide diversification benefits along Canadian traditional financial asset classes.

Following Pesando and Shum (1999), our CAPM results indicate that even when the ability of prints to promote diversification is considered, their return is not particularly attractive. The hypotheses testing of α and β equal to zero and one are all rejected at the 5 per cent critical level in favour of the alternatives. If the null hypothesis α=0 is rejected, this indicates that the returns of the art sample investigated are not adequately captured by CAPM, suggesting that systematic risk, measured by β, and non-systematic risk are both important factors for Cézanne's prints returns. Mei and Moses (2002) apply the CAPM framework to art returns and the S&P500 index returns and found the value of β to be 78.1 per cent. This result suggests that art objects have less systematic risk than the stock index and thus, should be expected to earn lower returns than the stock index over the long-term.

6. CONCLUSION

In this paper, we applied the hedonic regression method to examine the determinants of Cézanne's art pricing and draw some conclusions from its financial characteristics. We used price information of 930 sales that occurred in 13 countries over the period from January 1970 to December 2003. In our model, the logged price is a function to year dummies and a set of independent variables that control for a number of idiosyncratic attributes that included the type of painting (oil painting and works on paper), house of auction (Christie's and Sotheby's), city of auction (London, New York and Paris), country of auction (France, UK and US), size dimensions (height, width and surface) and working time sub-periods (1860-70, 1871-80, 1881-90 and 1891-1906).

Our results showed that higher prices paid for Cézanne's work are associated with the type of oil painting. Higher prices are also paid for larger paintings, but smaller values are placed upon very large paintings. The null hypothesis testing provided evidence for a degree of simultaneity across the location of sale, including the house of sale, the city of sale and the country of sale. This suggests that the presence of the Law of One Price cannot be rejected for the case of Cézanne's art. In addition, our results showed that work painted during Cézanne's later career sells at higher prices than his earlier work.

Our results also showed that Cézanne's returns weakly and conversely correlated with returns from other asset classes. The framework of CAPM yielded lower and negative estimates for β, suggesting weak effects from systematic risk. Nevertheless, investing in Cézanne's prints generated lower rates of annual returns and higher levels of risk compared to stock returns. Therefore, even though the weak correlations between Cézanne's art returns and returns from other asset classes can be indicative of the benefits for a diversified portfolio, the lower levels of returns associated with higher levels of risk does not provide solid evidence for diversification rewards.

Our findings are sensitive to the specification and methodology used in this study, particularly in the CAPM section. Goetzmann (1993) noted that the comparison of art returns to those of other assets should be implemented with care. This is because of the problems associated with the computation of art returns such as, amongst others, the choice of

methodology. Therefore, the issue of including Cézanne's art into a diversified portfolio is inconclusive.

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Appendix

Table no. 1 The most expensive paintings by Cézanne's

Rank	Title	Year of painting	Sale price USD	Auction house	City of sale	Country of sale	Date of auction
1	Rideau, cruchon et compotier	1894	55,000,000	Sotheby's	New York	USA	10/05/1999
2	La Montagne Sainte Victoire	1898	35,000,000	Phillips	New York	USA	07/05/2001
3	Bouilloire et fruits	1888	26,730,000	Sotheby's	London	UK	07/12/1999
4	Nature morte - les grosses pommes	1890	26,000,000	Sotheby's	New York	USA	11/05/1993
5	Madame Cézanne au fauteuil jaune	1888	21,000,000	Christie's	New York	USA	12/05/1997
6	Nature morte aux fruits et pot de gingembre	1895	16,610,001	Christie's	London	UK	28/06/2000
7	Pommes et serviette	-	15,600,000	Christie's	London	UK	27/11/1989
8	Portrait de Paul Cézanne	-	15,500,000	Christie's	New York	USA	07/05/2003
9	Pichet et assiette de poires	1890	15,250,000	Sotheby's	New York	USA	08/05/2002
10	Fillette a la poupee	-	15,000,000	Phillips	New York	USA	07/05/2001
11	Pichet de gres	1893	15,000,000	Sotheby's	New York	USA	11/11/1999
12	Les toits de l'Estaque	1883	11,500,000	Christie's	New York	USA	12/05/1997
13	Le chateau noir	1904	10,500,000	Christie's	New York	USA	19/11/1998
14	Pichet et fruits sur une table	-	10,500,000	Sotheby's	New York	USA	09/05/1989
15	La Cote du Galet a Pontoise	1881	10,000,000	Sotheby's	New York	USA	12/11/1996
16	L'Estaque vu a travers les pins	1882	10,000,000	Sotheby's	New York	USA	16/11/1998
	Total		**309,190,001**				

Table no. 2 Our observations according to medium and location of sale

Descriptive	Number of observation	Percentage to total sample
Type of painting		
Oil paintings	272	29.25%
Works on Paper	613	65.91%
Country of sale		
France	228	24.52%
UK	303	32.58%
USA	322	34.62%
City of sale		
Paris	208	22.37%
New York	314	33.76%
London	298	32.04%
House of sale		
Sotheby's	298	32.04%
Christie's	302	32.47%
Month of sale		
May/June	372	40.00%
Nov/ Dec	300	32.26%

Table no. 3 Descriptive statistics for our sample

Descriptive statistics	Works on Paper	Oil paintings	Christie's	Sotheby's	France	UK	USA	Paris	London	New York	Sample
Mean	85,462	2,155,975	688,798	1,109,114	105,171	535,647	1,399,431	105,926	544,489	1,435,003	687,826
Median	19,200	390,000	72,120	79,270	5,579	51,000	107,500	5,514	52,635	110,000	38,000
Maximum	3,933,000	55,000,000	21,000,000	55,000,000	7,765,500	26,730,000	55,000,000	7,765,500	26,730,000	55,000,000	55,000,000
Minimum	403	1,391	1,588	480	403	480	675	403	480	675	403
Std. Dev.	249,306	5,397,584	2,302,921	4,269,275	553,906	2,204,015	4,651,387	576,406	2,221,420	4,705,028	3,071,130
Std dev/mean	2.92	2.50	3.34	3.85	5.27	4.11	3.32	5.44	4.08	3.28	4.46
Skewness	9.02	5.54	5.96	8.59	12.01	8.30	7.13	11.67	8.23	7.04	10.09
Kurtosis	113.83	43.66	42.49	95.16	162.89	84.02	68.32	152.32	82.66	66.72	139.22
Jarque-Bera	322,054	20,126	21,409	109,133	248,359	86,351	59,981	197,967	82,159	55,719	734,838
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Observations	613	272	302	298	228	303	322	208	298	314	930

Table no. 4 Hedonic Regression Model for Cézanne's prints: 1970-2004

Dummies	Coefficients	Std. Err.	t-statistic	p-value	Price Index	Annual returns
Constant	5.9654	0.5973	9.99	0.00	-	-
Y1970	-1.5046	0.6880	-2.19	0.03	100.00	-
Y1971	-0.0277	0.7034	-0.04	0.97	437.91	1.4769
Y1972	-0.8502	0.6136	-1.39	0.17	192.39	-0.8225
Y1973	0.4255	0.7257	0.59	0.56	689.02	1.2758
Y1974	-0.0781	0.7257	-0.11	0.91	416.42	-0.5036
Y1975	-0.8204	0.9381	-0.87	0.38	198.22	-0.7423
Y1976	-0.8238	0.6159	-1.34	0.18	197.54	-0.0034
Y1977	-0.6600	0.6548	-1.01	0.31	232.70	0.1638
Y1978	0.4812	0.6006	0.80	0.42	728.49	1.1412
Y1979	-0.1850	0.5957	-0.31	0.76	374.18	-0.6662
Y1980	0.3126	0.6382	0.49	0.62	615.46	0.4976
Y1981	0.2082	0.6147	0.34	0.74	554.44	-0.1044
Y1982	-0.6138	0.6060	-1.01	0.31	243.70	-0.8220
Y1983	0.5474	0.6851	0.80	0.43	778.31	1.1612
Y1984	0.2857	0.6680	0.43	0.67	599.09	-0.2617
Y1985	0.2040	0.6319	0.32	0.75	552.10	-0.0817
Y1986	-0.2639	0.6087	-0.43	0.67	345.79	-0.4679
Y1987	1.5437	0.5783	2.67	0.01	2107.95	1.8076
Y1988	1.5826	0.6384	2.48	0.01	2191.60	0.0389
Y1989	1.5644	0.5678	2.76	0.01	2152.09	-0.0182
Y1990	1.3836	0.6113	2.26	0.02	1796.08	-0.1808
Y1991	1.1234	0.6123	1.83	0.07	1384.51	-0.2603
Y1992	0.9695	0.6135	1.58	0.11	1187.13	-0.1538
Y1993	0.3049	0.6217	0.49	0.62	610.70	-0.6647
Y1994	-0.6050	0.6512	-0.93	0.35	245.85	-0.9099
Y1995	-0.7457	0.5463	-1.37	0.17	213.59	-0.1407
Y1996	-0.5057	0.5569	-0.91	0.36	271.52	0.2400
Y1997	-0.0336	0.5448	-0.06	0.95	435.34	0.4721
Y1998	-0.0994	0.5493	-0.18	0.86	407.64	-0.0657
Y1999	-0.0231	0.5410	-0.04	0.97	439.95	0.0763
Y2000	0.0795	0.5497	0.14	0.89	487.48	0.1026
Y2001	0.2028	0.5357	0.38	0.71	551.43	0.1233
Y2002	-0.1674	0.5430	-0.31	0.76	380.83	-0.3702
Y2003	0.5621	0.5378	1.05	0.30	789.84	0.7295
Oil painting	2.9554	0.2525	11.70	0.00		
Works on paper	1.1690	0.2405	4.86	0.00		
London	1.1666	0.6394	1.82	0.07		
New York	2.1234	0.5289	4.01	0.00		
Paris	1.0831	0.3338	3.24	0.00		
France	-1.0378	0.3551	-2.92	0.00		
UK	-0.5137	0.6320	-0.81	0.42		
US	-1.3767	0.5059	-2.72	0.01		
Sotheby's	0.3576	0.2259	1.58	0.11		
Christie's	0.4421	0.2266	1.95	0.05		
Height (cm)	0.0415	0.0054	7.64	0.00		
Width (cm)	0.0359	0.0051	6.99	0.00		
Surface (cm2)	-0.0004	0.0000	-8.53	0.00		
Period 1860-1870	0.3914	0.2353	1.66	0.10		
Period 1871-1880	1.5564	0.2282	6.82	0.00		
Period 1881-1890	1.6023	0.2080	7.70	0.00		
Period 1891-1906	1.3201	0.2007	6.58	0.00		

R^2: 0.6731, Adj R^2: 0.6751, $F_{(51, 869)}$: 83.47 (0.000), Root RME: 1.3407.

Table no. 5 Annual Summary statistics for Cézanne's prints

Year	Average price	Total turnover	Min. price	Max. price	Median price	St. Dev	Number of sales
1970	135,000.00	1,215,000	480	432,000	14,000	190,471.61	9
1971	65,191.25	521,530	4,098	210,000	46,020	73,608.75	8
1972	106,216.00	1,805,672	6,024	624,000	28,050	175,498.74	17
1973	322,522.86	2,257,660	19,000	1,400,000	55,531	521,744.69	7
1974	260,594.86	1,824,164	5,974	702,667	70,743	295,477.17	7
1975	19,558.00	58,674	1,098	44,476	13,100	22,398.48	3
1976	79,108.31	1,265,733	941	329,600	54,500	97,779.80	16
1977	26,741.36	294,155	675	141,600	11,400	40,117.15	11
1978	149,743.14	3,144,606	3,096	564,000	141,000	141,432.08	21
1979	172,266.50	3,445,330	2,400	769,600	55,850	219,986.28	20
1980	636,461.54	8,274,000	5,200	3,900,000	140,000	1,078,711.86	13
1981	262,918.75	4,206,700	5,260	1,800,000	80,350	507,605.52	16
1982	115,107.22	2,071,930	1,200	660,000	25,300	206,559.07	18
1983	818,544.67	7,366,902	1,902	3,600,000	425,000	1,192,141.89	9
1984	278,237.50	2,782,375	1,620	1,600,000	75,520	500,729.68	10
1985	175,905.69	2,286,774	5,520	850,000	39,195	299,355.03	13
1986	296,892.82	5,047,178	6,250	1,350,000	39,000	433,394.53	17
1987	399,268.59	10,780,252	12,880	2,900,000	189,200	654,204.94	27
1988	2,335,040.93	32,690,573	31,790	8,400,000	653,200	3,034,352.37	14
1989	1,614,003.44	51,648,110	8,960	15,600,000	305,000	3,377,147.73	32
1990	668,938.53	11,371,955	4,600	6,500,000	283,523	1,550,224.76	17
1991	284,865.00	4,557,840	12,000	2,576,000	70,000	625,989.58	16
1992	1,252,783.71	21,297,323	15,071	5,056,000	458,400	1,517,106.70	17
1993	1,991,359.88	31,861,758	3,757	26,000,000	60,000	6,452,101.94	16
1994	191,912.75	2,302,953	711	950,000	66,570	305,450.79	12
1995	181,199.47	10,328,370	657	2,100,000	2,720	465,965.50	57
1996	507,054.90	21,296,306	651	10,000,000	6,780	1,886,104.50	42
1997	1,264,095.09	72,053,420	763	21,000,000	55,000	3,326,719.61	57
1998	812,065.70	40,603,285	637	10,500,000	32,000	2,280,745.80	50
1999	1,655,432.70	109,258,558	590	55,000,000	27,552	7,650,971.63	66
2000	842,475.74	39,596,360	427	16,610,001	25,380	2,742,376.74	47
2001	780,937.71	66,379,705	403	35,000,000	16,646	4,198,345.53	85
2002	396,859.61	28,177,032	730	15,250,000	10,780	1,905,508.24	71
2003	364,936.04	29,924,755	900	15,500,000	36,740	1,898,847.02	82

Table no. 6 Descriptive statistics for Returns

Descriptive statistic	Returns from Cézanne's art	Returns from Gold	Returns from S&P500	US 10 years Treasury Bond rate	US 3 month Treasury bill rate	Cézanne's art returns adjusted by US 10 years Treasury Bond rate	Cézanne's art returns adjusted by US 3 month Treasury bill rate	S&p500 returns adjusted by US 10 years Treasury Bond rate	S&p500 returns adjusted by US 3 month Treasury bill rate
Mean	0.0626	0.0593	0.0755	0.0770	0.0616	-0.0144	0.0011	-0.0015	0.0139
Median	-0.0657	0.0220	0.1169	0.0711	0.0560	-0.1122	-0.1096	0.0323	0.0583
Maximum	1.8076	0.8810	0.2935	0.1372	0.1549	1.7177	1.7499	0.2364	0.2421
Minimum	-0.9099	-0.1740	-0.3527	0.0403	0.0090	-0.9880	-0.9659	-0.4270	-0.4242
Std. Dev.	0.6887	0.1939	0.1673	0.0243	0.0301	0.6884	0.6875	0.1681	0.1684
St dev/mean	10.9966	3.2716	2.2161	0.3152	0.4890	-47.9554	640.7176	-111.1978	12.1010
Skewness	0.8587	2.4944	-0.7884	0.7647	0.8686	0.8431	0.8562	-0.6435	-0.6830
Kurtosis	3.1313	11.0144	2.8059	2.9767	4.5005	3.1126	3.1596	2.6284	2.7551
Jarque-Bera	4.0797	122.5369	3.4701	3.2172	7.2457	3.9273	4.0669	2.4676	2.6484
Probability	0.1301	0.0000	0.1764	0.2002	0.0267	0.1403	0.1309	0.2912	0.2660

Table no. 7 Correlation coefficients between art returns and selected conventional assets.(p-value between parentheses)

Variable	Returns from Cézanne's art	Returns from Gold	Returns from S&P500	US 10 years Treasury Bond rate	US 3 month Treasury bill rate	Cézanne's art returns adjusted by US 10 years Treasury Bond rate	Cézanne's art returns adjusted by US 3 month Treasury bill rate	S&p500 returns adjusted by US 10 years Treasury Bond rate	S&p500 returns adjusted by US 3 month Treasury bill rate
Returns from Cézanne's art	1.0000								
Returns from Gold	-0.1802	1.0000							
Returns from S&P500	-0.0135	-0.1117	1.0000						
US 10 years Treasury Bond rate	0.0308	0.0736	0.0364	1.0000					
US 3 month Treasury bill rate	0.0627	0.1862	0.0523	0.8585	1.0000				
Cézanne's art returns adjusted by US 10 years Treasury Bond rate	0.9994	-0.1829	-0.0148	-0.0044	0.0324	1.0000			
Cézanne's art returns adjusted by US 3 month Treasury bill rate	0.9990	-0.1887	-0.0158	-0.0067	0.0190	0.9997	1.0000		
S&p500 returns adjusted by US 10 years Treasury Bond rate	-0.0179	-0.1217	0.9895	-0.1081	-0.0719	-0.0141	-0.0147	1.0000	
S&p500 returns adjusted by US 3 month Treasury bill rate	-0.0246	-0.1442	0.9839	-0.1173	-0.1268	-0.0205	-0.0191	0.9958	1.0000

Table no. 8 CAPM framework

Specifications	Specification1: Nominal returns	Specification2: Adjusted to US Treasury 10 year Bond rate	Specification3: Adjusted to US Treasury 3 month bill Bond rate
α	0.0668 (0.4987)	-0.0144 (-0.1186)	0.0022 (0.0177)**
β (S&P500)	-0.0555 (-0.075)***	-0.0575 (-0.0782)***	-0.0779 (-0.1063)
R-squared	0.0002	0.0002	0.0004
Adjusted R-squared	-0.0321	-0.0321	-0.0319
S.E. of regression	0.6997	0.6993	0.6984
Sum squared resid	15.1760	15.1616	15.1191
Log likelihood	-34.0079	-33.9923	-33.9459
Durbin-Watson stat	2.4590	2.4496	2.4561
Mean dependent var	0.0626	-0.0144	0.0011
S.D. dependent var	0.6887	0.6884	0.6875
Akaike info criterion	2.1823	2.1813	2.1785
Schwarz criterion	2.2730	2.2720	2.2692
F-statistic	0.0002	0.0002	0.0004
Prob(F-statistic)	-0.0321	-0.0321	-0.0319
Hypothesis testing			
$\alpha=0$	0.25 (0.6215)	0.01 (0.9063)	0.00 (0.9860)
$\beta=0$	0.01 (0.9407)	0.01 (0.9381)	0.01 (0.9161)
$\beta=1$	2.04 (0.1635)	2.07 (0.1604)	2.16 (0.1516)

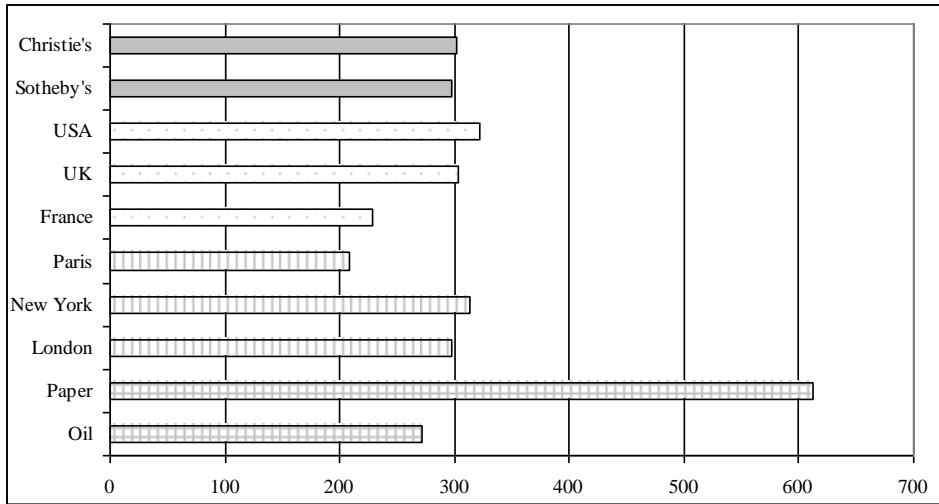** and *** denote significance at the 5 and 10% critical level.

**Figure no. 1 Number of observations according to house, city and country
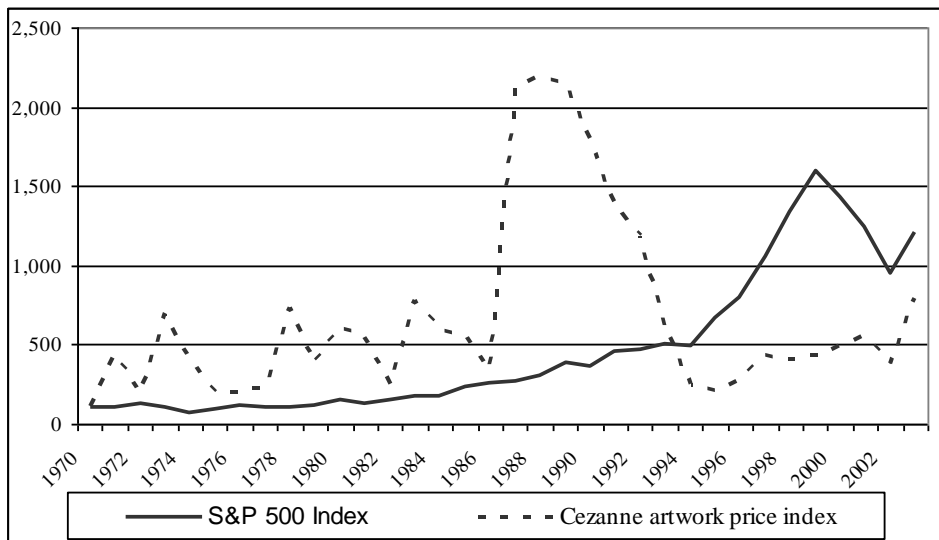of sales and medium of painting**

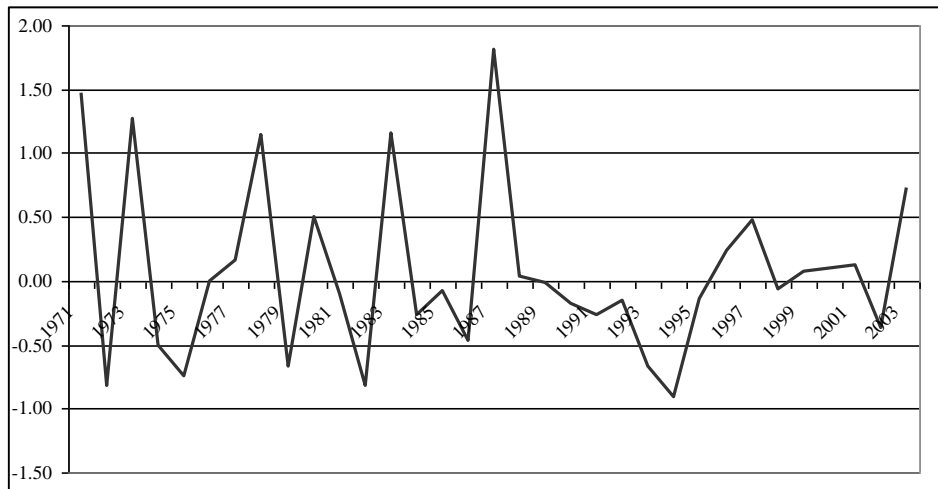
Figure no. 2 Time trend for S&P500 index and Cézanne's artworks

Figure no. 3 Annual returns for Cézanne's artworks (1970-2003)