The Capital Asset Pricing Model (CAPM) Applied to Paintings

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ABSTRACT

The Capital Asset Pricing Model (CAPM) has been used in a number of studies to explore the features of the art market (or individual artists). We claim that such studies have been based on unsuitable estimates of art market returns in the context of the CAPM methodology. The CAPM calls for employing total returns whereas most art-related studies rely on return estimates based on the time-dummies of hedonic pricing models. This choice is conceptually flawed since it is based on an ideal or average painting whose characteristics do not change overtime, and therefore, it does not capture total returns. We also claim that most indexes used in previous studies as proxy for the market are not able to capture the dynamics of the art market. These two observations call into question at least some of the findings of earlier researchers. Finally, we illustrate these points with several examples using actual auction prices for a group of surrealist artists. We also advance some proposals to overcome the above-mentioned shortcomings.

Keywords Art markets Hedonic pricing CAPM Returns Indices

JEL Classification C18 D44 G11 G12 Z10

INTRODUCTION

Stein (1977) was probably the first author who applied the Capital Asset Pricing Model (CAPM) to paintings. He focused on the U.S. and British markets and hinted that an important part of the return attributed to paintings was due entirely to the viewing pleasure they provide.

Chanel et al. (1994) studied the returns for several groups of painters (Italian, English, Impressionists, etc.) and invoking the CAPM suggested that their returns were comparable to those of stocks but less risky. Mei and Moses (2002), using repeat-sales data and the CAPM, concluded that investing in art, in the long run, should not outperform the S&P 500. Pesando (2003) employed the CAPM in conjunction with repeat-sales data to study modern prints instead of paintings. Hodgson and Vorkink (2003) applied the CAPM to valuation of Canadian artists' paintings. Edwards (2004) used the CAPM to analyze the returns of Latin American artists and concluded that they exhibited low correlation with international stocks. Atukeren and Seckin (2007) used the CAPM to measure the so-called "psychic" returns that some authors have attributed to investing in paintings and estimated it around 28% for their dataset. More recently, Kraeussl and Lee (2010) studied what they considered the top-500 artists in the world; and based on the CAPM, found that art returns exhibited a correlation of approximately 25% with stocks. All these studies, and many others, have employed the CAPM as a tool to gain insight into a number of art market-related issues but did not concern themselves with questioning its applicability to this market.

Agnello (2006), on the contrary, appears to be the first researcher who actually explored the validity of the CAPM in the context of paintings (instead of using it to investigate issues related to the art market). Moreover, he also applied the CAPM to both, groups of artists and individual painters, and found the evidence to be unsupportive of the CAPM.

It is difficult to find any common ground in the conclusions of the previous CAPM-related studies. In fact, the opposite is probably true. Particularly, in terms of the merits of investing in art from a diversification viewpoint and the likelihood that art could provide attractive risk-adjusted returns.

There are, however, some commonalities in terms of the shortcomings affecting these studies. A common mistake is to use the wrong return estimate to plug into the CAPM equation. The

second mistake consists of using the wrong market index. Both issues are explored and discussed in detail in this paper. These issues are critical for they call into question most of the conclusions based on previous CAPM-related work as it applies to the art market.

The next section states the CAPM more formally; we follow with a discussion on how to estimate returns and what index to use; then we describe our data; afterwards we present our results; and we end the paper with some conclusions.

THE CAPM

The CAPM states that the total return (R) of an asset, during a specific period, can be expressed as follows (Sharpe, 1964),

$$R = R_f + \beta [R_M - R_f]$$

where R_f is the risk-free rate; R_M represents the market return during the same period; and β, which, in theory can be approximated as β = Covariance (R_M, R)/ Variance (R_M), indicates how sensitive the asset returns are with respect to the market.

It is fair to say that the validity of the CAPM in more conventional markets such as stocks, bonds, real estate, etc. has been questioned based on a great deal of empirical evidence. Leaving that aside, the CAPM has been routinely employed to explore the extent to which an asset moves with the market, and the potential diversification benefits that it provides.

Without discussing at length the validity of the CAPM assumptions in general, we should mention that there are three violations to the CAPM that are unique to the art market. First, paintings (unlike stocks or bonds) cannot be shorted. Second, investors cannot hold a fraction of a painting. Third, there is plenty of evidence that art market investors are not variance-minimizers. Hence, whatever validity the CAPM might have when dealing with more conventional assets, in the art market, its applicability is likely to be less compelling.

THE PROBLEM WITH ART RETURNS

The R on the left hand side of the CAPM equation is the total return delivered by the asset during a specific period; that is, a return computed without controlling for any characteristics.

By way of example, if we were analyzing IBM, we would compute the return for the period in question based on the price-variation of the IBM stock during that period. Such return would be the total (actual, real, or true) return; in other words, the "real thing," not an estimate.

Unfortunately, in the case of paintings there is no such a thing as the true or real return. Therefore, in the CAPM equation, we are forced to place −instead of the real thing− a proxy for something that we are not even sure exists, in the strict sense of the term.

As a result, many researchers, without realizing the implications of their decision, have opted for using the return estimates provided by the time-dummies of a suitable hedonic pricing model based on the logarithm of the price. Conceptually, it is difficult to defend this choice for such return is based on an ideal or average painting whose attributes remain constant over time. In essence, it would not capture the supply-demand dynamics that are a *sine qua non* condition to reflect a total return. A plausible interpretation of the time dummies-based return is that it reflects a "pure" market return. But whatever the correct interpretation of this return is, one fact remains clear: it is not a total return.

Surprisingly, the consequences of this choice, which might be defensible in the context of building a price index, have not been questioned in the context of the CAPM. The oddity of the above-mentioned choice to estimate a total return becomes more obvious if we go back to our original example. Can you picture an analyst estimating the price-variation of IBM stock, after controlling for revenue composition, number of employees, or domestic versus foreign sales? That is, trying to estimate the stock return for an ideal and unchanged IBM over time?

Furthermore, there is another serious problem with using return estimates based on the time-dummies: Fisher's monotonicity condition (Fisher 1922); or, more accurately, the violation of this monotonicity condition. Mesner (2005) demonstrated that price-indices based on the time-dummies do not satisfy this condition. In other words, an increase in the price(s) might result in a decrease in the value of the index. Clearly, returns based on this approach, could be spurious. Charlin and Cifuentes (2014a) have explored this issue in more detail in the context of the art market.

In short, the difficulties for estimating the total return come from the fact that it is difficult to specify the true return for paintings. Note that repeat-sales returns are in fact total returns; but

this choice is often unsuitable since in most cases there is insufficient data in addition to the well-known selection bias.

Therefore, we propose to explore five choices to estimate R. Namely, estimate R based on: (1) the time-dummies from the hedonic pricing model using the all the sales available for a specific artist or group of artists; (2) the year-to-year change of geometric mean of the price; (3) the year-to-year change of the geometric mean of the Artistic Power Value[1] (APV) which is the price per unit of area; (4) the year-to-year change of the price trimmed-mean; and (5) the year-to-year change of the APV trimmed-mean. The trimmed-mean, in this case, is simply the mean after deleting the top- and bottom-5% of the observations recorded in every year (period).

None of these choices is perfect. However, they all have something in common: they represent an attempt to estimate the total return; that is, a return without eliminating the effects of any of the factors contributing to it. Our goal is not really to endorse any of these alternatives: it is simply to see the implications of making different decisions to estimate R.

CHOICE OF MARKET INDEX

The art market is a global market, not a U.S.-based market. Therefore, it makes little sense to use as a proxy for the relevant market the S&P 500. It would be far more appropriate to use the MSCI World Index as reference. Some researchers (although not all of them) have performed their CAPM-related analysis using the S&P 500. Others have relied on the MSCI World Index. This question, however, is only relevant if stocks were the appropriate reference market.

We claim that the art market has little in common with either stocks or bonds, and therefore, we should test the CAPM with an index that actually captures the art market dynamics. The low correlations found by previous studies between art market returns and either stocks or bonds support this view. Thus, in this study we use as proxy for the art market, the index returns provided by Luc Renneboog and Christophe Spaenjers (2013). We refer to this index as the RS Art index; The last year covered by the RS Art index is 2007.

[1] For details about this metric see Charlin, Ventura and Cifuentes, Arturo, A New Financial Metric for the Art Market. Available at SSRN: http://ssrn.com/abstract=2291569. See also a forthcoming paper in the Journal of Alternative Investments (An Investor-Oriented Metric for the Art Market).

THE DATA

The dataset consists of 25-years (1988-2012) worth of public auctions realized prices as reported by artnet [www.artnet.com] and includes the sales of five surrealist artists: Giorgio de Chirico, Max Ernst, René Magritte, Roberto Matta, and Joan Miró. Table 1 summarizes the key attributes of the dataset. We normalized the data to be expressed in terms of premium prices.

In all we have 3,520 observations distributed not very unevenly among the five artists: we have 903 observations for Matta and 556 for Magritte (the others fall in between). Price variations either measured through the APV or directly, are notorious. Their distributions are markedly non-normal, and, as expected, the APV exhibits less variability than the raw prices (since it controls for the area).

Table 1
Detailed characteristics and key statistics of the artists included in the dataset

	Giorgio De Chirico	Max Ernst	René Magritte	Roberto Matta	Joan Miró	All Artists group (AAG)
Number of Obs.	757	579	556	903	725	3,520
Price Median (US $)	120,724	142,436	435,099	59,293	278,387	143,545
Price Geometric Mean (US $)	136,580	156,264	444,997	67,461	293,798	164,423
Price Average (US $)	298,395	353,739	949,362	128,913	988,450	508,972
Standard Deviation (US $)	751,675	875,967	1,573,721	285,791	2,597,118	1,474,873
Coeff. of Variation	2.52	2.48	1.66	2.22	2.63	2.90
Skewness	11.09	12.20	3.86	9.02	7.12	10.21
Kurtosis	170.08	201.65	17.81	116.29	71.91	166.55
Jarque-Bera test	927,874	995,339	8,730	521,017	162,313	4,129,339
JB *p*-value	0.000	0.000	0.000	0.000	0.000	0.000
APV Median (US $/cm^2)	60	123	248	6	113	66
APV Geometric Mean (US $/cm^2)	64	115	263	7	121	58
APV Average (US $/cm^2)	95	195	513	16	343	208
Standard Deviation (US $/cm^2)	134	296	782	38	685	492
Coeff. of Variation	1.41	1.52	1.52	2.40	1.99	2.36
Skewness	6.88	6.30	4.30	5.88	4.34	6.43
Kurtosis	68.63	55.18	27.85	41.92	24.37	60.44
Jarque-Bera test	154,557	77,273	19,686	71,302	20,211	560,083
JB *p*-value	0.000	0.000	0.000	0.000	0.000	0.000

Table 2. Returns and correlations

Variable	Mean Return	Std. Dev.	Correlations: RS Art Index*	S&P 500**	MSCI World Index**	Risk Free Rate***
De Chirico (Time Dummies)	0.029	0.221	0.624	-0.041	0.188	0.046
De Chirico (Price Geometric Mean)	0.055	0.394	0.427	0.002	-0.065	0.002
De Chirico (APV Geometric Mean)	0.049	0.266	0.501	-0.024	0.056	-0.079
De Chirico (Price Trimmed-Mean)	0.125	0.535	0.446	0.026	-0.001	0.150
De Chirico (APV Trimmed-Mean)	0.066	0.320	0.550	0.057	0.027	-0.030
Ernst (Time Dummies)	0.091	0.300	0.657	0.209	-0.038	0.206
Ernst (Price Geometric Mean)	0.115	0.429	0.193	0.125	-0.050	-0.002
Ernst (APV Geometric Mean)	0.091	0.310	0.220	0.157	0.192	0.112
Ernst (Price Trimmed-Mean)	0.125	0.433	0.189	0.070	-0.029	-0.077
Ernst (APV Trimmed-Mean)	0.097	0.330	0.243	0.124	0.286	0.063
Magritte (Time Dummies)	0.137	0.379	0.515	0.183	-0.012	0.084
Magritte (Price Geometric Mean)	0.227	0.633	-0.036	0.054	-0.162	0.056
Magritte (APV Geometric Mean)	0.158	0.465	0.276	0.018	-0.083	0.005
Magritte (Price Trimmed-Mean)	0.200	0.531	0.110	0.245	-0.067	0.111
Magritte (APV Trimmed-Mean)	0.176	0.489	0.255	-0.004	-0.085	0.021
Matta (Time Dummies)	0.076	0.252	0.731	0.078	0.059	0.271
Matta (Price Geometric Mean)	0.114	0.377	0.466	-0.163	0.023	0.167
Matta (APV Geometric Mean)	0.103	0.383	0.610	-0.027	0.015	0.232
Matta (Price Trimmed-Mean)	0.140	0.480	0.369	-0.218	0.030	0.151
Matta (APV Trimmed-Mean)	0.211	0.762	0.351	-0.190	0.072	0.012
Miro (Time Dummies)	0.040	0.234	0.647	0.113	0.132	-0.015
Miro (Price Geometric Mean)	0.130	0.496	0.398	0.111	0.244	-0.099
Miro (APV Geometric Mean)	0.124	0.486	0.316	0.050	-0.067	-0.200
Miro (Price Trimmed-Mean)	0.253	0.661	0.508	0.184	0.266	0.065
Miro (APV Trimmed-Mean)	0.200	0.614	0.449	0.030	0.041	-0.111
AAG (Time Dummies)	0.078	0.241	0.804	0.142	0.045	0.228
AAG (Price Geometric Mean)	0.079	0.262	0.601	0.115	0.015	-0.111
AAG (APV Geometric Mean)	0.081	0.296	0.510	0.154	-0.043	-0.190
AAG (Price Trimmed-Mean)	0.103	0.343	0.534	0.173	0.036	-0.103
AAG (APV Trimmed-Mean)	0.101	0.295	0.607	0.233	0.027	-0.231
RS Art Index*	0.029	0.143	1	0.084	0.062	0.050
S&P 500 **	0.081	0.143	0.084	1	0.475	0.418
MSCI World Index **	0.060	0.181	0.062	0.475	1	0.029
Risk Free Rate ***	0.039	0.024	0.050	0.418	0.029	1

* This is the Renneboog and Spaenjers (2013) Art Index for the years 1989-2007 (19 periods).
**The S&P 500 and the MSCI World Index are for the years 1989-2012 (24 periods).
*** The Risk Free Rate is the 1 yr US Treasury yield for the years 1989-2012 (24 periods).
NOTE: the correlations with the RS Art Index consider the 1989-2007 period.

Table 3. CAPM results

	RS Art Index*						S&P 500**		MSCI World Index**	
Variable	β	Std. Error	Lower 95% CI Limit	Upper 95% CI Limit	t	*p*-value	β	Std. Error	β	Std. Error
De Chirico (Time Dummies)	1.088	0.322	0.409	1.766	3.38	0.00	-0.133	0.348	0.233	0.255
De Chirico (Price Geometric Mean)	1.324	0.653	-0.055	2.702	2.03	0.06	-0.042	0.623	-0.128	0.462
De Chirico (APV Geometric Mean)	1.088	0.428	0.186	1.990	2.55	0.02	-0.302	0.436	-0.034	0.327
De Chirico (Price Trimmed-Mean)	1.788	0.893	-0.096	3.671	2.00	0.06	-0.043	0.840	-0.048	0.623
De Chirico (APV Trimmed-Mean)	1.396	0.494	0.354	2.439	2.83	0.01	0.109	0.508	0.0682	0.377
Ernst (Time Dummies)	1.359	0.402	0.510	2.207	3.38	0.00	0.365	0.461	-0.095	0.347
Ernst (Price Geometric Mean)	0.517	0.681	-0.921	1.954	0.76	0.46	0.375	0.674	-0.105	0.503
Ernst (APV Geometric Mean)	0.474	0.558	-0.702	1.650	0.85	0.41	0.213	0.539	0.255	0.398
Ernst (Price Trimmed-Mean)	0.518	0.658	-0.869	1.906	0.79	0.44	0.236	0.686	-0.031	0.511
Ernst (APV Trimmed-Mean)	0.584	0.593	-0.667	1.835	0.98	0.34	0.246	0.517	0.515	0.370
Magritte (Time Dummies)	1.462	0.600	0.196	2.728	2.44	0.03	0.455	0.588	-0.035	0.443
Magritte (Price Geometric Mean)	-0.183	1.127	-2.559	2.194	-0.16	0.87	0.173	0.997	-0.577	0.731
Magritte (APV Geometric Mean)	1.015	0.837	-0.752	2.781	1.21	0.24	-0.102	0.558	0.085	0.414
Magritte (Price Trimmed-Mean)	0.348	0.909	-1.569	2.266	0.38	0.71	0.897	0.813	-0.224	0.618
Magritte (APV Trimmed-Mean)	0.960	0.885	-0.906	2.827	1.09	0.29	-0.075	0.772	-0.221	0.572
Matta (Time Dummies)	1.341	0.326	0.653	2.028	4.11	0.00	0.017	0.389	0.045	0.288
Matta (Price Geometric Mean)	1.244	0.616	-0.055	2.543	2.02	0.06	-0.613	0.575	0.016	0.438
Matta (APV Geometric Mean)	1.722	0.574	0.510	2.934	3.00	0.01	-0.002	0.477	-0.420	0.343
Matta (Price Trimmed-Mean)	1.277	0.832	-0.478	3.033	1.53	0.14	-0.964	0.724	0.040	0.558
Matta (APV Trimmed-Mean)	2.136	1.333	-0.676	4.948	1.60	0.13	-1.198	1.176	0.305	0.891
Miro (Time Dummies)	1.149	0.323	0.466	1.831	3.55	0.00	0.166	0.371	0.186	0.274
Miro (Price Geometric Mean)	1.136	0.660	-0.256	2.528	1.72	0.10	0.451	0.782	0.710	0.566
Miro (APV Geometric Mean)	1.253	0.833	-0.504	3.010	1.50	0.15	-0.069	0.893	-0.969	0.630
Miro (Price Trimmed-Mean)	2.125	0.932	0.159	4.091	2.28	0.04	0.851	1.026	0.946	0.747
Miro (APV Trimmed-Mean)	2.052	0.955	0.037	4.067	2.15	0.05	0.187	0.973	0.201	0.722
AAG (Time Dummies)	1.437	0.273	0.861	2.014	5.26	0.00	0.149	0.373	0.033	0.278
AAG (Price Geometric Mean)	1.055	0.336	0.345	1.764	3.14	0.01	0.228	0.416	0.056	0.311
AAG (APV Geometric Mean)	0.991	0.386	0.178	1.805	2.57	0.02	0.585	0.460	0.107	0.353
AAG (Price Trimmed-Mean)	1.196	0.364	0.428	1.963	3.29	0.00	0.467	0.538	0.107	0.406
AAG (APV Trimmed-Mean)	1.104	0.425	0.206	2.001	2.60	0.02	0.585	0.460	0.107	0.353

* CAPM computed using the Renneboog and Spaenjers (2013) Art Index for years 1989-2007 (19 periods).

** CAPM computed using the S&P 500 and the MSCI World Index for years 1989-2012 (24 periods).

Table 2 displays the mean and their standard deviation for returns estimated using the five choices discussed. It also shows the correlations for several combinations of: (1) the three market indexes (RS Art Index, S&P 500, and MSCI World Index); and (2) the five return estimates.

A few observations are in order. The returns computed for each artist, with the different estimates (metrics), differ substantially. Additionally, for each artist the time-dummies returns are always smaller than the other estimated returns. This is perhaps to be expected since the time-dummies returns reflect a return once the variations in the characteristics of the paintings have been removed. Also as expected, the returns for the group (aggregate) show less variability than those of individual artists; the five returns estimates, for the all artists group (AAG), show a much smaller level of discrepancy.

Finally, individual painters return correlations, with either the S&P 500 or the MSCI index are very small. The opposite occurs with the RS Art Index. This trend is more evident for the all artists group. Clearly, whatever the drivers of the art market are, it is obvious that they are unrelated to stock market dynamics.

RESULTS

Table 3 summarizes the results. The CAPM-related calculations using the RS Art Index were performed only for the 1989 – 2007 period. The calculations using the S&P 500 and the MSCI World indexes were conducted for the 1989 – 2012 period. As expected, not much can be concluded from the cases in which the index is a stock index, other than the fact that almost all the β's confidence intervals contain the zero. In short, stocks and paintings are fairly unconnected.

Results using the RS Art Index are more interesting. In the case of the three artists that exhibit significant or marginally significant values (De Chirico, Matta and Miro) the β's all show the same tendencies; and in almost all instances the time-dummies' β's are lower than the others. This situation is somehow consistent with the trends displayed by the returns themselves. What is most disturbing is the degree of dependency on the choice to estimate the returns. For example, let us examine Miro. We can conclude that its return either moves with the market (β close to 1) or is as twice as volatile as the art market (β close to 2) depending on what return

estimate we believe. If we add to this finding that the return estimates are at best just that, estimates (as opposed to the true value), one cannot help but wonder if there is any point in attempting to derive sweeping conclusions from these CAPM exercises.

The β's computed for the group of artists, as expected, are all significant. They show less variability among them when compared with those of individual painters. A somewhat puzzling result is that the β calculated with the time-dummies indicates that the artists, taken together, are more volatile than individually. This is not what the β's computed with any of the other return estimates indicate. Interestingly enough, the coefficients of variation reported in Table 1 for the average price and the average APV hint that the group exhibits more variability than the individual artists. Is this an indication that returns estimated with the time-dummies are capturing these volatilities and thus are more sensitive? Or simply, are the time-dummies' returns more unstable?

CONCLUDING REMARKS

The results of this analysis offer some illuminating points regarding the CAPM and its usefulness for art market-related applications.

[1] The market for paintings and stocks do seem to be highly disconnected. Not much can be concluded from any CAPM analysis using stock market indexes as a proxy for the market.

[2] Using return estimates for individual artists based on the time-dummies of hedonic models is not correct for these returns do not fully capture supply-demand market dynamics. They are not total returns.

[3] Several alternatives, with competing claims for validity, can be advanced to estimate total returns in the case of individual painters. It is not clear which one is the correct one for the very definition of actual return is unclear in the market for paintings. Unfortunately, estimates for β's vary a great deal depending of this choice.

[4] In the case of an index aimed at capturing broader art market tendencies (not aimed at estimating the total return for an artist or group of artists) the use of the time-dummies of the hedonic model seems to be, at least conceptually, a valid choice.

[5] However, the fact that price-indices based on the time-dummies do not satisfy Fisher's monotonicity condition, casts doubt on the reliability of such return estimates. It is difficult to ascertain whether they are spurious or not.

[6] Finally, we must consider that the previously estimated returns (using any method) are just that, estimates and therefore they contain an error. If that error is taken into account (which for the sake of simplicity was not considered in these analyses) the estimated β's would have even broader confidence intervals.

All in all, the previous statements raise important doubts on the validity of earlier CAPM-related findings. Moreover, if we take into consideration: (1) the three violations of the CAPM assumptions (already mentioned) that occur in the market for paintings; (2) the weak empirical foundation supporting the CAPM in most conventional markets; (3) the great deal of variability in the results obtained depending on how the returns are estimated; and (4) the ambiguity as to which is the best metric or method to estimate total returns for paintings, we are left with one inevitably conclusion: not much can be expected from attempting to shed light into any aspects of the art market by invoking the CAPM. Perhaps all CAPM-related efforts should be abandoned for good.

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