African Journal of Hospitality, Tourism and Leisure, Volume 6 (4) - (2017) ISSN: 2223-814X

Disempowering institutional behaviour by exploring the risks associated with investing into the Fine Art Market

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Abstract

Research illustrates that the procurement and selling of fine art are extremely psychological. The wealthy classes infrequently buy fine aesthetic objects for merely financial reasons. There is a sense of emotional gratification from acquiring attractive fine art but it can be a risky enterprise when purchased not only as a leisure activity, but also as an investment. Purchasers of fine art derive immense pleasure from exhibiting their art in their home and also share art with their peers. Owning fine art also grants one greater social status but given that the valuation of fine art is highly subjective, if one's motivations are purely financial, and not necessarily leisure-based, this makes investing in fine art decidedly risky. This article examines the role of institutions in the global art market. Due to the asymmetrical distribution of information between art investors and the art institutions, there is uncertainty over the value of 'Fine Art' between those that wish to indirectly manipulate the price of art for the benefit of the institution, and those that wish to invest into the 'Fine Art' market. The value of 'Fine Art' is determined by the 'Value of Information', which has a direct positive relationship between quantity of information that the institution plans to hold, and the amount of uncertainty in the market.

Key Words: Art Institutions, Fine Art, Art Investment, Risk and Uncertainty, the 'Value of Information'

Introduction

While it is evident that highly efficient markets may generate only very marginal returns, inefficient markets may create far better returns for investors in 'Fine Art'. Coffman (1998) alludes to this by arguing that a portfolio manager is constantly searching for profits within assets that will yield above normal risk-adjusted returns. It is further suggested that bargains are often unlikely in conventional financial assets found in typical efficient functioning markets. Efficiency may not extend across all of the market, thus, it is in this inefficient market that bargains become apparent, especially where these bargains may be found in tangible assets, most common in the market for art and antiques (Coffman, 1989).

However, the market for 'Fine Art' would in any other market condition be viable if the market for 'Fine Art' would be efficient, yet, as we have already established the primary market for 'Fine Art' is far from efficient, while the secondary market exhibits degrees of efficiency.

A price transmission process between the secondary and the primary market is very evident in the market for 'Fine Art'. This transmission mechanism is created in the process of trading across both markets (Coffman, 1989). This transmission mechanism not only bridges the gap between the primary and secondary art market, but also has a regulating feature which is not purely a function of price (Baur, 2014). This transmission mechanism of information across the market for 'Fine Art' is a function of power distribution (Dunn, 2001), where the inefficiency in the market creates a platform for excessive profits for the players within the 'Fine Art' market. Information is the cornerstone relating to both strategy and the non-competitiveness of art within the asset markets. This is derived through the 'value' of the information that investors are prepared to

compensate in order to offset the uncertainty associated with diversifying portfolios from the asset market into the art market, as an alternative.

Methodology

The methodology used in this paper applies the CAPM model to examine the risk associated with investment into the 'Fine Art' market. The Capital Asset Pricing Model (CAPM) is a financial model which analyses the relationship between systematic risk (overall market risk) and the expected returns for a specific asset or group of assets. The data analysis is performed by applying secondary annual data provided by the ARTprice index (2017) and S&P500 data provided by Reuters (2017), examining the relationship using the Ordinary leased Squares method of data analysis. Once suitable structural breaks were identified, the Tobin Model was found to be statistically significant, proving the role of institutions in price setting behaviour**.**

Market inefficiency or induced structural change?

The asymmetrical distribution of information, or the lack thereof, is a large driver of market inefficiency in the market for 'Fine Art'. However, market inefficiency has only some of the answers, and it would be deemed appropriate to look at some additional aspects, specifically those aspects which relate to structural change. Such elements captured in the 'structural change' hypothesis could include modernisation, changing tastes and preferences, the type and nature of available data, the impact of evolving technology and the ease of finding new information. This is further emphasised by Mei and Moses (2002), whom state that when considering a case of 'structural change' within the (art) market, then, it would be more suitable for a researcher to choose a new model that would embrace 'structural change' rejecting the more common financial theories which are based on 'efficient financial markets', especially for the case where the markets evolve in a random manner, with unpredictable outcomes.

In this case, the structural change theory could better explain (Erdos & Ormos, 2010) such features as the impact of globalisation on the sales of art, the ever expanding art market into the emerging markets, driven by the changing distribution of income and the growth of middle class economies in developing countries. Including here is the appearance of new investors and the introduction of more transparent price estimates into the primary art market through online auction houses and main stream art galleries who trade though the internet.

Much of this 'change' is driven by beliefs and the belief systems inherent in the decision-making process. But, the facts confronting the decision-maker change faster than their held belief systems, to the extent that, a strategy which is based on beliefs, may be a reasonable measure of strategic rigidity. In order to enhance the realism of cognition, it is important to incorporate insight and intuition into the decision-making process. Insight is a process which involves the comparison of alternatives or problems leading to a shift in gestalt (an organized whole that is perceived as more than the sum of its parts), while insight involves a shift in adaptations based on deep, intimate knowledge of markets and situations (Eisenhardt & Zbaracki, 1992). Insight gives the decision-maker a heightened appreciation of the uncertainty that exists within the environment.

Yet, under uncertainty, the more traditional approaches to strategic planning can be considered downright dangerous (Courtney et al., 1997) because planning on uncertainty creates an intellectual temptation for cognitive dissonance and confirmatory bias. The ultimate effect of this is that uncertainty undermines the value of flexibility of the decision-making process (Fitzsimmons, 2006). This is most relevant when examining the interaction between the institution (providers of information) and the firms (who make use of that information). Dunn (2001) points out that the essence of the institution is not about the set of transactions, but rather it's all about the strategic decision-making that can be implemented into the market for some ultimate gain. As such, the institutions may engage with others in a non-competitive activity, for example, tactical collusion. Some companies may affect decisions which yield unique power or advantages to themselves, such as, the distribution of resources or gains at the expense of other companies.

People engage in predefined political tactics which includes co-operation, coalition formation, and control of information, to enrich their own influence.

The political perspective of this approach is the process by which conflict is resolved among competing organisations with individual perspectives. Typically, most organisational decisions follow the requirements and related choices of the most authoritative decision-makers. While decision-makers may often attempt to change the power structure by engaging in political tactics such as, cooperation strategies, the formation of coalitions and the strategic use of information (Eisenhardt & Zbaracki, 1992). Despite the available technology and rapid online trading, Coffman (1989) mentions that while the international market for most assets may be increasingly efficient (symmetrical distribution of information), the market for art would be considered inefficient (where information about art related assets remains asymmetrical). Asymmetry of information would provide opportunities for the institutions to create above normal returns to their investment. Thus, investment establishments could be seen as political systems in which strategic decision-makers have sometimes discerned objectives, while the buyers are limited through lack of expertise.

Strategic decision-making may be seen as an interlacing of 'bounded rationality' and a complicated political processes. Thus, because of this 'bounded rationality', investors are often lacking the expertise to fully understand their investment decisions. Strategic decision-makers engage in political games which most noticeably have an influence in the market (Eisenhardt & Zbaracki, 1992). Information relating to a specific work of art or even information on a specific artist may be harder to acquire and interpret due to the lack of 'real' market transparency.

Information and value

As a starting point, let's assume that acquiring Information about artwork of a specific artist, within a specific market, has a price of its own. The more useful the information is for the investor, the higher the value of that information, and the more likely it is to have a higher price. However, the value of this information may change over time and even holding 'perfect' information may have an expiry date. In other words, as suggested in the work of Chao (1981), 'perfect' information that an investor may require could possibly have a time limit, in that, for any short-run decisions regarding relatively inelastic pricing for an exhaustive product such as 'Fine Art', where the discount rate is sufficiently high, the future uncertainties become irrelevant, making the expected value of perfect information at that point in time unimportant to the long run decision.

While the amount of information around any specific asset may correlate with the degree of market efficiency, the quantity and quality of information gives insight into the expected return of that asset. Thus, the price of an asset should also reflect the 'value of information' associated with that asset. This critical argument is further motivated by David Lawrence (1987), who mentions that the expected 'value' of the information regarding the decision to trade in a unit of art, which represents the maximum amount that the decision-maker should invest into the analysis of the art or artist, before making the decision to invest. In the case of having perfect information, it would then be very easy to estimate the 'true' value of the asset which also depends on the accuracy of the information acquired (Lawrence, 1987). Accurate information provides an investor with a chance to make a better strategic decision so as to gain from the opportunities made available. However, the accuracy of the information is somewhat subjective, being that there are two sides to this coin.

On the one side of the coin, the investor is constantly seeking better and more reliable information from which to make a suitable decision. On the other side of the coin, the institution could be holding back information that would be of benefit to the investor. It might be considered a less than desirable option for the institution to release all of the information held, for it is within this imperfect market with asemantic information flows, that larger profits may be possible. The

decision to withhold information by the institution for its own gain is the basis of, what we are referring to in this paper as ‘Strategic Uncertainty’.

Strategic uncertainty and the value of information

Conditions of ‘risk’ are those conditions that prevail in situations where the future outcomes are unknown, yet the probabilities of the outcomes can be estimated. Conditions of uncertainty (Fitzsimmons, 2006) are characterised by those conditions where there is no basis for estimating future probabilities. Uncertainty defines the strategic and operational environment today, and despite its intuitive appeal, applying uncertainty to strategic planning could be quite problematic and may inhibit the flexibility in the decision-making process.

Uncertainty, in itself might not be completely devoid of probability. Lipshitz and Strauss (1997), suggest that while uncertainty is sometimes seen as a situation in which one has no knowledge about which of several states of nature has occurred or will occur, uncertainty is also sometimes seen as a situation in which one knows only the probability of which several possible states will occur. Thus, uncertainty is the inability to assert with certainty the ‘act-event’ sequences, the ‘event-event’ sequences, the ‘value of consequences’ made in any decision-making process. In any appropriate decision-making process, there will always be the inability to determine any accurate future preferences or actions, and therein lies the inability to effectively affect any future events (Lipshitz & Strauss, 1997). From this perspective, it’s the application of 'Strategic Uncertainty' which provides a possible explanation for the beliefs of an individual (Morris & Shin, 2002) whose behaviour exactly mimics the equilibrium behaviour of other decision-makers within an environment which has a strong information constraint, thus, exhibiting a degree of ‘bounded rationality’.

Strategic decision-making is suitably described as a combination of bounded rationality and political insights, deciding when to co-ordinate strategies with competitors to form strategic alliances. Eisenhardt and Zbaracki (1992) point out that bounded rationality shapes the cognitive parameters and encompassing the strategic decision processes, while the political outlook shapes the social context (Eisenhardt & Zbaracki, 1992). For a case, where the product is homogeneous, and when competition is reciprocating as in price competition, ‘antagonistic strategies’ may develop, resulting in price wars and the eventual erosion of profit margins for all sides (Smit & Trigeorgis, 2006). Any increase in strategic opportunities corresponds with an increase in potential utility. This increase in the potential utility of information corresponds to a financial value (or price) and it is this value which is usually referred to as the 'Value of Information’. Decisions regarding the specific assets been traded, the strategies been implemented and the preferences of the individual investors is related to the 'Value of Information'. However, it must be stated that the same information can have different values for different investors (Yang et al., 2011), yet despite the non-specificity of the 'Value of Information', using the 'Value of Information' in a probabilistic analysis, can, according to Claxton, Neumann, Ariak and Weinstein (2001), contribute towards important decision-making strategies, such as, in setting up decision priorities, establishing a technically efficient decision-making design, and in so doing, efficient investment decisions. However, these decisions are not without a degree of Strategic Uncertainty.

Exploring strategic uncertainty in the art market

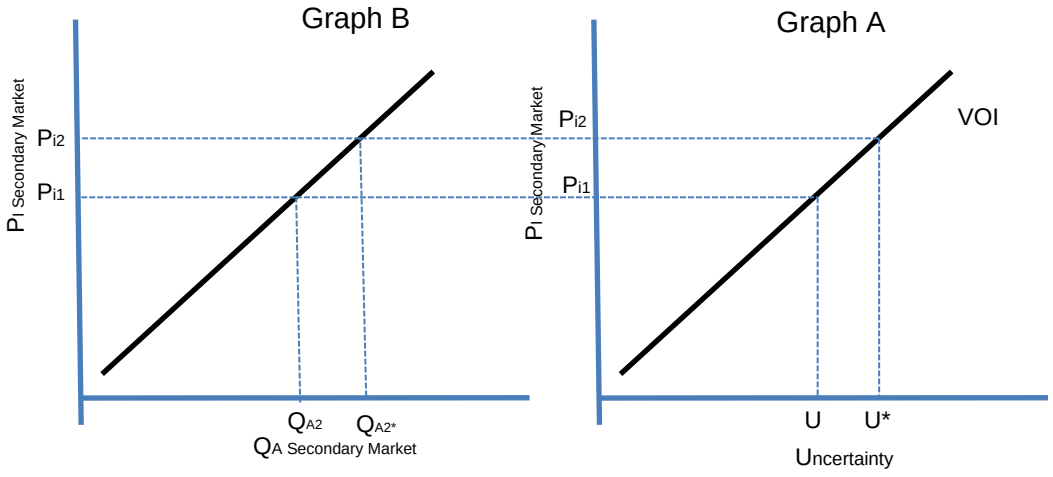
'Strategic Uncertainty' is that uncertainty concerning actions and beliefs (and the beliefs about the beliefs of other people). This is slightly different from ‘Structural Uncertainty’ where the uncertainty is down to the fundamentals displayed in the inadequacy of an economic model, sometimes referred to as model bias, or even model discrepancy (Morris & Shin, 2002). Within the art market, investors theoretically choose a particular optimal strategy. To the investor, this strategy may be optimal, even though they may hold narrow beliefs about the actions taken by

other investors. In such situations, even the slightest uncertainty about other investors' choices might lead an investor to deviate from his or her equilibrium strategy (Andersson et al., 2014). However, individuals have social (distributional) preferences and/or reciprocal preferences. Consequently, they dislike inequality in rewards and according to Cabrales, Miniaci, Provesan and Ponti (2006), inequalities in rewards are often necessary to force the high-effort required to find suitable information that will add value to the investment by reducing the uncertainty. Given the search for available information, much of the decision-making within the realm of uncertainty must hold several essential elements which makes the response of individuals very different from each other and sometimes very difficult to predict, namely, the elements of 'subjectivity', 'inclusivity' and ultimately, 'affect'. 'Subjectivity' would be seen as different levels of doubt for similar situations. 'Inclusivity' would hold within it, for example, ignorance of future outcomes. Finally the 'affect' would embrace behaviours, such as, hesitancy to make a decision, indecisiveness or even procrastination, thus making uncertainty highly subjective (Lipshitz & Strauss, 1997) and resulting in choices that may not be optimal. Thus, for a decision process to result in an optimal choice, it must be oriented toward achieving appropriate goals, based on accurate information associating various substitutes to these goals, and also based on accepting and understanding the current environmental constraints at the time of the decision (Dean Jr & Sharfman, 1996). This implies that choices follow a dynamic process, and in the words Chao (1981), if the 'Value of Information' for certain products are dynamic, then it would further imply that choices may follow some form of changing pattern too, depending on who the specific investor is, and what kind of risk strategies the investor would be prepared to follow. It may be safe to suggest that for high levels of uncertainty associated with a choice to investment, the 'Value of Information' for that uncertainty would be high. If the level of uncertainty were to decrease, then the 'Value of Information' for that choice would decrease too.

Determining the slope of the 'value of information curve, for 'fine art'

The higher the uncertainty, the greater the price that people would be prepared to pay for information relating to that uncertainty. The more art one plans to invest in, the more choices need to be made (Graph B in figure 1), and the greater the uncertainty and the higher the price that an investor would plan to pay to acquire such information to offset the associated uncertainty (Graph A in figure 1). The relationship between price of information and the quantity of art invested into would have a positive relationship (VOI in Graph A of Figure 1). In other words, plotting the 'Value of Information' curve would typically have a positive relationship between quantity of art invested (more choices) and the price to acquire the specific information. The sensitivity to uncertainty would determine the steepness of the slope to such a relationship. The positive slope also implies a supply side relationship. In other words, it is not the demand for information, but the supply of information that determines the sensitivity relationship. Art institutions hold information, and it's through the supply of this information that affects the choice to invest into art.

FIGURE 1: Uncertainty and the price of information. Source: Baur & Els (2015)



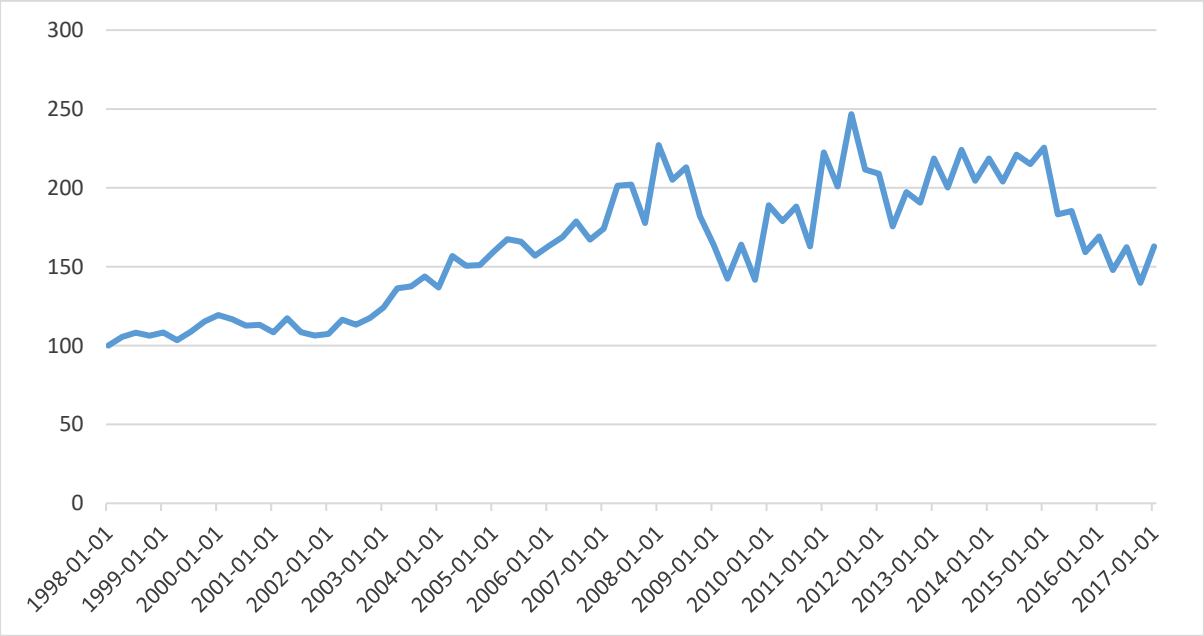
African Journal of Hospitality, Tourism and Leisure, Volume 6 (4) - (2017) ISSN: 2223-814X

If the decision to invest would be deemed perfectly insensitive to the uncertainty, then the 'Value of Information' would be perfectly vertical (inelastic), at which point, the price of the information has no relationship to the quantity of the art been invested. In this case the choice to invest would not more be related to the quantity of art been invested but rather on a specific piece of information that would be deemed relevant to that investor. At this point the supply and demand for art on the secondary art market, (which determines the price of the art on the secondary art market), has no impact on the value of art been traded on the primary art market. The primary art market becomes disassociated from the secondary art market.

Yang, Ewald and Wang (2011) mention that the choice of an investor or dealer depends on how much information in individual investor or dealer already has at his disposal. The value of this information is then obtained by estimating the level of the optimal expected utility that the investor or dealer can gain by acquiring additional information given his current amount of information and an increased in the level of information that he may acquire over time. The primary art market suppliers are aware that by sharing some types of information, especially confidential business information (such as the motives underlying promoting certain types of 'Fine Art'), may undermine their competitive position through undermining pricing strategies and quite inadvertently lowering the levels of market uncertainty, resulting in losing their competitive position further (Hsiao, 2005). This may result an increase in demand by investors or the rapid increase in the supply of tradable works of art, which would be measurable in the increase in the number of transactions.

The additional supply of art into the market may have a negative impact on the exchange of higher price items, such as works of art by the well-known artists, and will see more of the lesser known names entering into the market. This became very apparent on the international art market post 2013. While the number of transactions increased, the returns for investments into art began to fall, resulting in the decrease of the Artprice index.

FIGURE 2: Changes in the Artprice index from1998-2017, 1998=100.



Source: Artprice.com (2017)

Information sharing, leading to greater efficiency or not ?

In order to drive greater market efficiency, the relationship between 'Value of Information' and uncertainty could be reduced with the aid of 'information sharing'. If all parties would share information, even to the point of perfect information, then the uncertainty of investing in 'Fine Art' would be reduced, and the market wold become increasingly efficient. This idea is supported by the work of Hsiao and Shieh (2006), who point out that information sharing plays an important part in harmonizing various factors involved in the investment decision of the assist. Yet, this would not automatically translate into an optimal strategy by the players in the art market. An optimal solution would most likely involve holding information by the institutions. Hsiao and Shieh (2006) emphasise that because players in the market for 'Fine Art' have their own profit maximising aims, institutions would prefer to hold certain information, creating an inefficient market environment. If they would cooperate with each other, the market would become more efficient, reducing uncertainty and potentially lowering potential profits. This would result in the increase in supply of art into the market, and while there would be greater efficiency, there may be greater risk to the investor as possible future returns would possibly be reduced. Thus, the market may rally on the greater efficiency, the decision to invest into 'Fine Art' by the investors in the primary market may become quite bearish.

If the distribution of information is asymmetric, and the cost of withholding information is relatively inexpensive, then institutions will hold back more information. This allows institutions within the market to save resources by offering other investors substantially less information. The principal of 'Strategic Uncertainty' faces a trade-off between fairness and robustness: fairness can be obtained only at the expense of robustness (Cabrales et al., 2010).

Morris and Shin (2002) mention that if private information is sufficiently accurate, relative to the amount of available public information, then a market position of multiple equilibria would coexist with different people holding common knowledge of the fundamentals inherent in the investment.

The accuracy of this public information can reveal complex effects that arise from the interplay between holding, releasing or interpreting this information. An investor's exertion of effort to acquire additional information induces a positive externality on the effectiveness of other investors. Some investors may believe that the effort to acquire this information is paid off through higher returns, with other investors confidently believing that these highly paid (informed) investors will make more of an effort to contribute towards the market.

Therefore, the cost of the institution to hold back on information starts to rise with the investors seeking out new information, or creating their own information. The higher cost of holding such information increases (shown as Y2 X2 to Y1 X1 in figure 2). If the cost of holding such information increases, institutions may find it more difficult to hold onto the information, reducing the information asymmetry. At this stage in the game, investors now find information gathering less expensive and can hold more information than before.

The shift of information from the institutions to the investors (A1 to B1 in figure 2, Graph C) induces an increase in demand for 'Fine Art' (Di1 to Di2 in figure 2, Graph D), reducing the overall risk as perceived future returns to the art investment begins to increase. Alternatively the supply of art begins to increase (Si1 to Si1* in figure 2 of Graph D), increasing risk for the investor, as perceived profits begin to fall.

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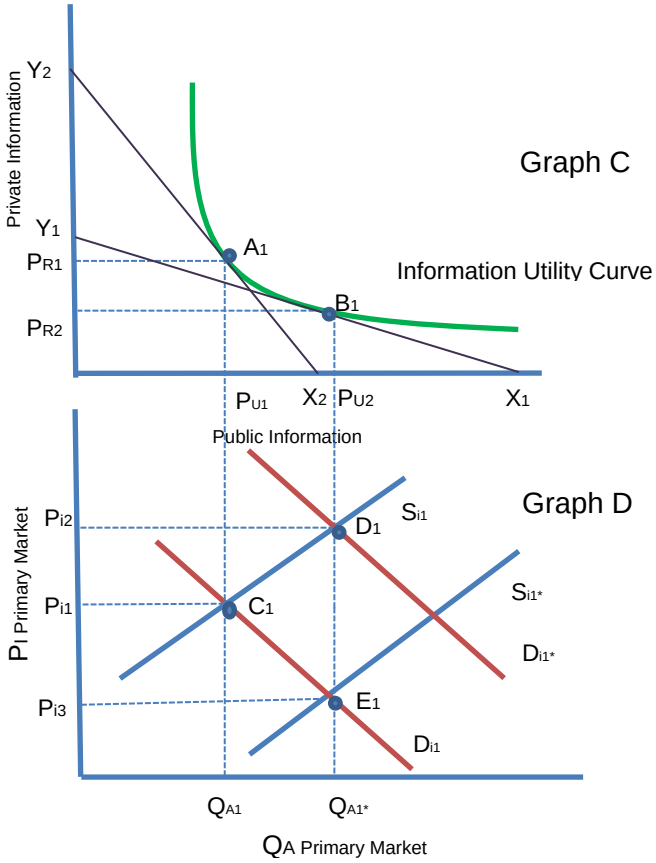
FIGURE 3: The role of the institution and the demand for information in the primary art market.



Source: Baur & Els (2015)

A biased distribution of information

Investment into information may influence the competitor's behaviour, which in turn influences the resulting equilibrium (Smit & Trigeorgis, 2006), in such a way that it strengthens their own competitive position, and presumably the long-term value of the investment. For this purpose, there are two types of information that need to be distinguished from each other, namely, 'public information' and 'private information'. Public information refers to that information that is (somewhat freely) available to investors. Private information is that information that is held by the institution. Institutions protect their information that they have, as it is important in determining 'assumed' value, highlighted in their own individual's informational preferences and beliefs. We might assume that the players (investors and institutions) in the market already display a significant degree of heterogeneity in their preference for information (Cabrales et al., 2010). Within the market, equality of information is of less importance than the robustness of information. Also it is assumed that a fair distribution of information yields inefficient outcomes, lowering potential profitability. The primary decision-makers or 'principals' (Cabrales et al., 2010) arrange their requirements for information according to their own social preferences. These principals usually set contracts in tune with their own estimated information distribution preferences, even if these contracts operate under a 'Veil of Ignorance', wherein the individual players will hope to win eventually.

Players using information that 'does not quantify the risk', make decisions in ignorance (without any suitable information on probabilities and utilities) (Lipshitz & Strauss, 1997). The 'ignorance' mentioned here implies that, according to Aberg (2015:256) "a priori distribution in principle has an infinite variance but since we must attribute the ability to the decision maker to enumerate all

the future states of nature and to specify the pay-off matrix in order to avoid a partial solution, we must assume that he treats the set of future outcomes as a bounded set"

Decision-making within the framework of ignorance can be pounded down to the use of assumption based reasoning, and an over reliance on 'expert' opinion, which can sometimes be referred to, in the words of Aberg (2015), 'partially ignorant' because the probabilistic beliefs or even the probability distribution is given without any reference to any suitable observation of a 'real' nature. While this may reduce uncertainty-induced-anxiety, it may give rise to 'cognitive dissonance', which is a situation where the goals are inconsistent across different people at different times, while the search for information is often locally (using the same sources of information) and which is generally both biased and standardised (Eisenhardt & Zbaracki, 1992). This may induce a new set of conflicts for the decision-maker. These conflicts experienced by the decision-maker is habitually pacified through 'herd-like' behaviour mentality, or, in other words, the 'political' decision-making processes. Investors seeking new information may feel overwhelmed when confronted with endless layers of somewhat contradictory information. Also, no real relief is provided by the 'experts', who are also, somewhat inadvertently, blanketing the many information gaps. This could be illustrated with a football game as an analogy. In this football game the players are all blindfolded, and the many spectators are standing at the lines, shouting to the player's many different suggestions of what the players should do, often making comments, sometimes giving commands, while the players themselves are trying to avoid bumping into each other in the search for the ball. But the ball itself may have left the field, and nobody really knows.

While effective decisions should be based around organizational goals, the political decision-making process is organized around the self-interests of individuals or in some cases, around group thinking. This is discussed at length in the work of Dean and Sharfman (1996), who show how group decision-making processes can influence decision-making performance. However, it is the processes of individual rationalization that threatens an individual's decision success, and in experiments, it has been shown that group thinking can improve decision-making under uncertainty. Group thinking does not necessarily representing the interests of the individual and the individual will still choose that action which provides the greatest expected utility (Aberg, 2015).

The decision-maker may consider a number of approaches in order to rationalise this decision, even if following the preferences of the group. Information symmetry (brought about by the increase in the amount of public information) is not totally detrimental to firms. While pre-emption may reduce risk (Chevalier-Roignant et al., 2011), Morris and Shin (2002) mention that an increase in public information may convey additional information on the underlying fundamentals about value. This additional information serves as a focal point for the group (investors and institutions alike). Public information may serve to reinforce the impact on individual decisions to the detriment of private information (Morris & Shin, 2002). The cost associated with protecting the information held by the institutions is 'optimal' to the institution, by guaranteeing returns. Gordon and Loeb (2002) mentions that the type of information an institution would need to protect would include issues such as the confidentiality, availability, authenticity, non-repudiation, and integrity of the artist or art been traded.

These institutions incur costs such as professional fees, hospitality and travel costs, IT costs, packaging and shipping fees, costs for insurance and security, restoration and conservation fees, art fairs and marketing costs (Petterson, 2011). At the extreme level the private source of information may 'crowd out' any public information. This means that (Gordon, 2002) due to the higher risk associated with investing into a relatively unknown artist entering into the market, the greater the cost associated with protecting that information about the artist.

Dunn (2001) proposes that, in an uncertain environment, the centrality of control and power is of prime importance. There is an overwhelming need to acquire control of strategic cost factors (such as the information pertaining to the artist), in order to mitigate the impact of the uncertain

market environment, which is paramount in ensuring the survival of the company and possibly even the market.

Modern portfolio decision-making deals with a long-term vision based on uncertainty, and according to Oh, Yang and Lee (2012), the uncertainty focuses specifically on the levels of insufficient information which may lead to unreliable decisions. As new markets are appearing, the product life cycle for most assets appear to be getting shorter, and as the costs associated with maintaining a market share through innovation are getting higher, many companies have to continuously introduce new products to the market, and strategic planning to promote and protect the assets is critical (Oh et al., 2012).

However, in a relatively stable business environment, even powerful tools used to analytically predict the future can fail as many factors exist outside of the business within the environment which contain such high levels of uncertainty and where predictions are less than suitably reliable from where to make sound strategic decisions (Courtney et al., 1997).

It may also become too expensive for an institution to monitor an entire market to protect even small levels of information change. According to Morris and Shin (2002), when there is sufficient information concerning the underlying asset, the equilibrium in the market maximizes social welfare. When there exists sufficient levels of imperfect information, the welfare effects of an increase in the amount of public information could have very uncertain results for the investor as the market can also over react to the change in public information.

Establishing the right amount of information is then paramount to the primary market, and often, securing such market inefficiency is such an important component of price setting behaviour. Risks to such institutions could include breaching of confidentiality or where multiple sources of potential information about an artist is leaked into the public sector. The increased sensitivities within the market for 'Fine Art' could magnify any disruptive ‘noise’ of the public information to such a large extent that (Morris & Shin, 2002) the available public information increases or when investors distrust the information that they have, creating more harm than good within the market. This would imply that even though incomplete information is the most frequently cited source of uncertainty, the decision-maker is often unable to make a decision. This is because of the overabundance of information combined with conflicting meanings (Lipshitz & Strauss, 1997). This situation may induce conflict or dissidence or doubt for an investor when trying to determine where the most suitable investment might lie. In this situation there might not be a change in the demand for information, as the information that is held by the decision-maker is understood, remain undifferentiated, and any change in information does not show any positive or negative gains to the decision-making process. Therefore, investors do not move from their existing portfolios, there is no desire to seek additional information.

When analysing the 'Value of Information', the possible increase in uncertainty or the reduction of the expected loss of returns to the 'Fine Art' asset needs to be appropriately assessed, once all the information about that artist has entered into the market. Chevalier-Roignant, Flath, Huchzermeier and Trigeorgis (2011) suggest that an investor can effectively make an early strategic investment that alters the later game structure by inducing an ‘asymmetry of information’ among other investors, in other words, by sharing additional information with selected players. The strategic effect depends on the intent, commitment and competitive reaction of the other players. It might appear that early ‘‘overinvestment’’ is the optimal solution as the leading firm acquires a strategic advantage by blocking the market to new potential entrants.

Under extreme market uncertainty, the incentive to make a settled investment is limited (but not impossible) when supposing that future prospects for the market could be too risky. Any initial investment decision requires that the committing firm weighs the cost of a commitment against the expected future strategic benefits (Chevalier-Roignant et al., 2011).

Information as a risk factor

Companies may analyse their portfolio regularly for efficient resource allocations, and the alignment of the asset portfolios with their corporate strategies. Consistent analysis is required because the portfolio decision-making significantly affects not only annual sales and profits but also long-term growth (Oh et al., 2012). Related to growth are risks and the risks that are nearly absent in the financial market are sometimes very substantial in the arts market (Frey & Cueni, 2013).

Trying to determine the optimal amount to spend on protecting the 'Value of Information' of 'Fine Art' is an increasing function of the level of vulnerability of such information (Gordon, 2002). Fitzsimmons (2006) emphasises this by stating that unchecked belief systems based on scepticism has the power to marginalise the appropriate analysis of this information. This results in large additional cost for 'ambiguous benefits' by certain decision-makers through parochial interests which completely undermine the flexibility in the market (Fitzsimmons, 2006).

The information hungry market has led to the increase in the production of anticipatory statistics (such as an increase in art price indices, art market reports, market analysis) and more extensive use of econometric forecasting models to determine future market outcomes. Nevertheless, the nature of forecast information varies according to the type of decision problem involved and the type of strategy used to manage those uncertainties (Aberg, 2015), and these vary from investor to investor.

Claxton, Neumann, Araki and Weinstein (2001), mention that in an inefficient market, information is particularly valuable to investors as it can help reduce expected costs associated with the uncertainty involved in the decision-making process. Information is vulnerable to interpretation adding to the scepticism of the decision-maker. The expected costs of uncertainty are determined by the probability that an investment decision which is based on existing information could be incorrect. The associated costs of uncertainty can also be seen as the expected value of been able to acquire perfect information.

The cost to the investor for this information would be the maximum amount that a decision-maker would be willing to pay for additional information into an investment decision with the aim of improving decisions in the future. If the expected value of perfect information exceeds the expected costs of finding any additional information, then it would then be potentially more cost-effective for an investor to find more information. The more an investor is prepared to invest in finding additional information, the more likely that the investor would be to reduce the uncertainty surrounding his investment decision (Claxton et al., 2001).

In other words, greater levels of uncertainty means the more an investor would be prepared to pay for such information. This may not always be the case, as highlighted by the work of Eeckhoud and Godfroid (1995), mentioning that there are going to be situations (but not the norm) where the higher the risk, the lower the 'Value of Information', despite the widely accepted view that the 'Value of Information' has a positive relationship with risk and uncertainty. Not having such information would be a risk factor that the investor would need to build into the decision-making model. If there is little or no information about a particular artist, then that would translate into high level of risk to the investor. In order to offset the risk associated with introducing a new or even a relatively unknown artist into the art market, a large amount of information gathering would be simultaneously required to offset this risk.

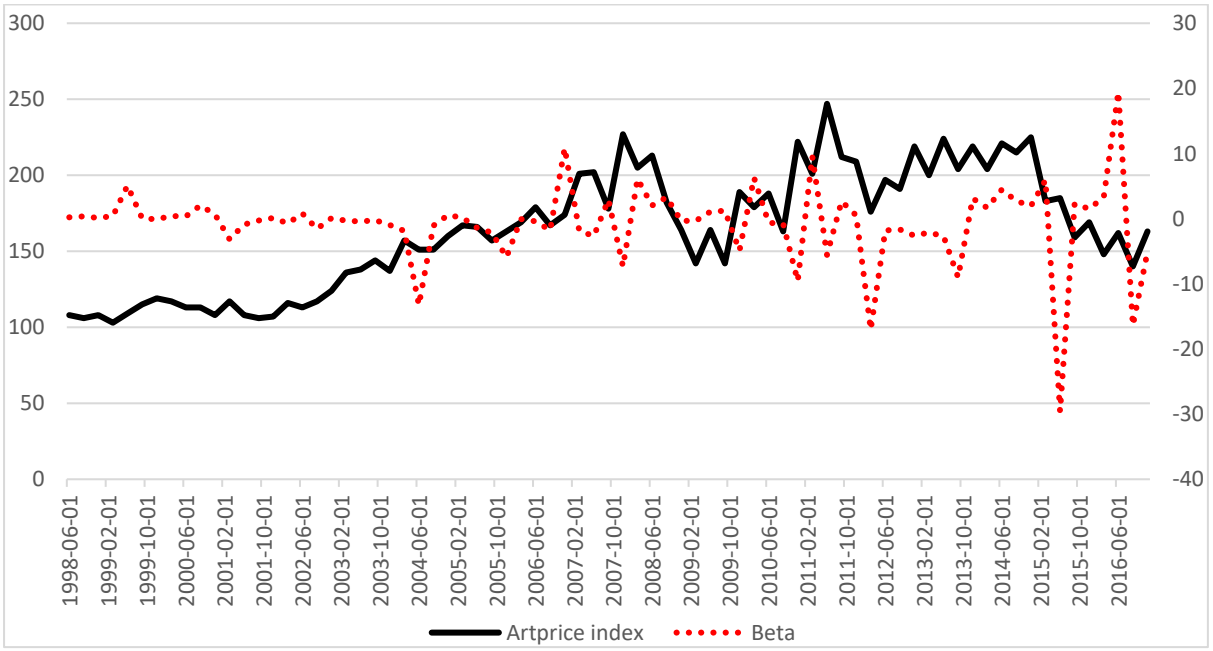
Measuring risk associated with the market for 'Fine Art' using the CAPM model

This paper uses the CAPM model to examine the risk associated with investment into the 'Fine Art' market. The Capital Asset Pricing Model (CAPM) is a financial model which analyses the relationship between systematic risk (overall market risk) and the expected returns for a specific asset or group of assets. The generalised formula for CAPM is: $r_a = r_f + \beta(R_m - r_f) + \alpha$, where r_a

is the risk associated with the asset, r_f is the risk free rate, (or the risk of the standardised market indicator, such as S&P 500), R_m is the expected market return, alpha (α) is the intercept and β is the risk index value. While α is usually not a part of the CAPM model, it represents the vertical intercept and gives an indication of how much better or worse the asset performed compared to what the CAPM predicted. There are two components to this model, namely the time value of money and risk. The time value of money is represented by the risk-free (r_f) rate, a compensation for investors for investing in over a period of time. The risk-free rate is that investment that is used for a benchmark, and in many cases the S&P 500 is used.

The CAPM equation denotes risk and estimates the compensation which the investor needs for taking on any additional risk. This is estimated by taking a risk measure Beta, (β), which compares the returns to the asset over a period of time to the market premium (R_m-r_f). Beta reflects how risky an asset is compared to overall market risk and is a function of the volatility of the asset and the market as well as the correlation between the two. In other words, this model examines the expected return of an asset or portfolio, which equals the rate on a risk-free asset and an additional risk premium.

FIGURE 4: Artprice index and Beta (β) for the art price index using S&P 500 as the risk free index Source: Artprice Index and Reuters Data (2017)



For the market for 'Fine Art', using the Artprice index against the S&P 500, the adjusted R^2 value 0.31 implies that only 31% of the assets performance is explained by the risk exposure. The alfa (α) value, indicating the performance of the asset indicates that the art market underperformed (α = -150.84). According to Baur (2017), the low performance of the market for 'Fine Art' is as a result of other factors, such as the value of the asset to investors, and other social, psychological and institutional factors. 'Art' as an investment item may be different from other conventional investments in that art may also be a 'store of value', which has very different behavioural trends from equity markets, where equities would be seen as a means of generating profit while the 'art' market may be perceived as a market for goods which hold profit.

The average value of Beta (β), between 1998 and 2016 was -0.2817. Usually one would expect that the value of Beta to be positive. However, in the case of commodities, where there is a store of value, such as in gold, then a negative beta would imply a 'store of value'. This occurred 48% of the time between 1998 and 2017. If the value of beta is greater than 1, it implies that the art market is riskier than the general market, but potentially more profitable than the S&P 500 (this

occurred 52% of the time), and in the case of beta greater than 0 but less than 1, it would imply that the art market is less risky, but with lower returns to the S&P 500. This only occurred 19% of the time between 1998 and 2017.

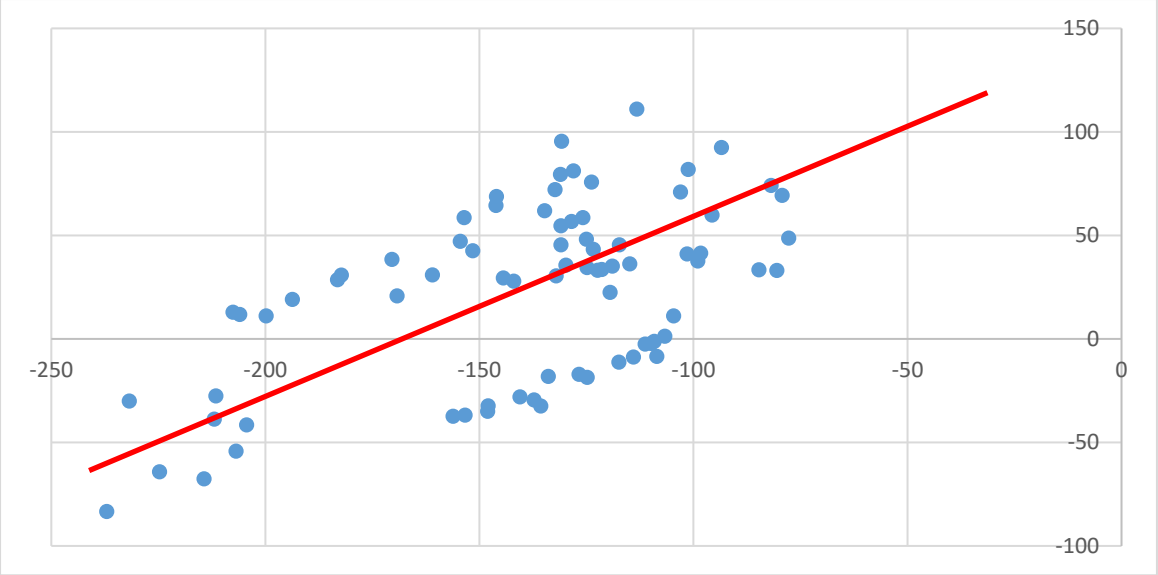
Using structural breaks to justify the relationship between Tobin's Speculative Demand as behaviour towards risk

Karmakar (2016), Van der Merwe, Mollentze, Leshoro, Vermeulen (2014) mention that Tobin developed a model for the demand of an asset in which he suggested that people do not only consider the expected return from that asset, but also the risk associated with holding that asset. Tobin therefore constructs a model considering that the demand for the asset is also a store of wealth. In this example, Art is also a store of wealth (Baur, 2017). The focus of this model is on an individual's portfolio allocation between assets and a risk free investment subject to the wealth constraint. In Tobin's theory, we can assume that the expected capital gain is zero, because the individual investor expects capital gains and losses to be equally probable.

The best expectation of returns, as in this study, S&P 500, is simply the prevailing market rate of interest (i), which is also the amount of the expected return on that investment. It can be assumed that the S&P 500 investment is largely risk free. The actual return also includes capital gains or losses, as the interest rate does not generally remain fixed. Risk free assets provide an expected return of interest, but the actual return is uncertain due to the fact that the market rate of interest fluctuates even in the short run. If only art is held in the portfolio, returns would be maximum, the risk to which the investor is exposed will also be maximum. A risk averse investor would voluntarily sacrifice some return for a reduction in risk of his portfolio.

Tobin's theory indicates that on the vertical axis of the upper quadrant we measure the expected return to the portfolio (r-r_f) and on the horizontal axis we measure the riskiness of the portfolio (K_m-r_f). The expected return on the portfolio is the potential gain that can be earned on risk free asset (Karmakar, 2016). Using the CAPM model to plot the relationships of the returns to the Artprice index and the returns to the S&P 500 index, indicates a positive relationship. The associated relationship would be in the format of (r_a - r_f) and (R_m - r_f), with a 56% correlation.

FIGURE 5: Deriving the 'value of information curve' using CAPM methodology for returns to the Artprice index between 1998 and 2017.



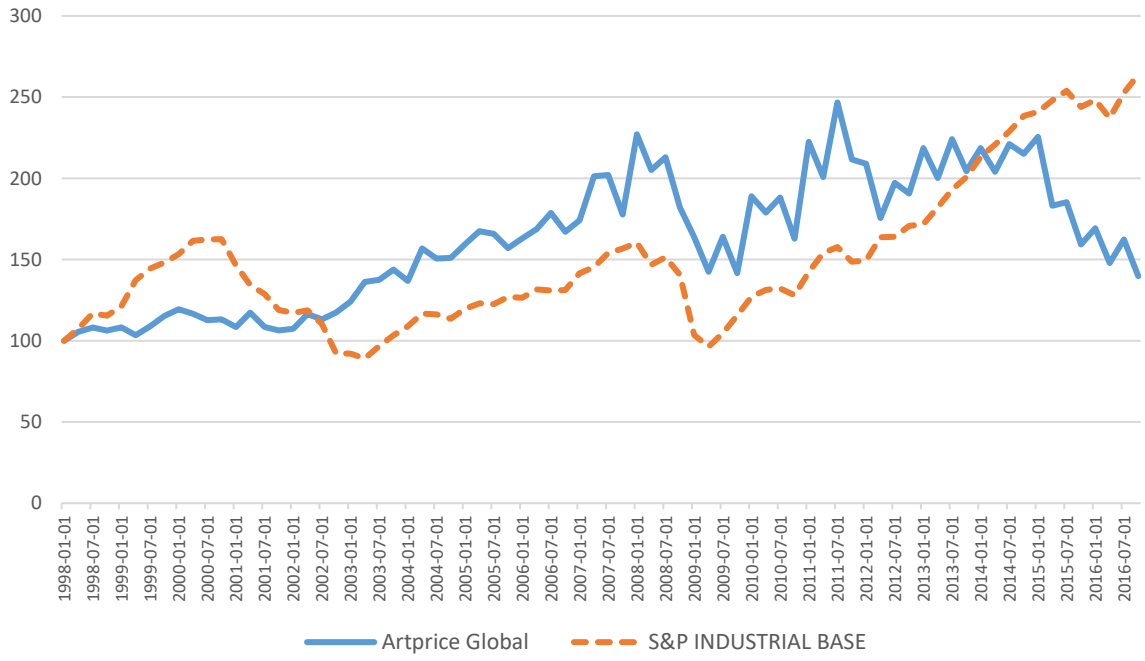
Source: Data derived from Artprice index and Reuters SPX (2017)

Figure 5 shows the positive relationship between the returns to the Artprice index and the returns to the S&P 500. Despite the wide dispersion of the scatterplot, the clearly positive relationship exists and is consistent with the concept of 'Value of Information', in other words, according to van der Merwe et.al., (2014), an opportunity line which shows the relationship between risk and return. The attitude of individual investors within this model will be shown by individual indifference curves. The slope of the individual indifference curves is determined by the attitude of the individual's portfolio holders towards risk.

There are two major structural breaks that are identified in this paper, namely, 1998 to 2008, 2008 to 2013, and 2013 to 2017. According to Baur (2017), art as a store of value, is often used by investors as a hedge against inflation (as in commodities), rather than as a profit function. The movement in art prices is highly correlated with the movement in commodity prices (adjusted R^2 of 0.88). When considering the correlation between the Artprice index, and the two structural breaks, (Baur, 2017) it can be deduced that there is a far greater correlation between the Artprice Index and the first structural break (2008) with a 61% correlation.

The correlation between the Artprice index and the second structural break (2013) shows a lower correlation of 29%. Yet, by separating the regressions, one for before 2013 and post 2013, the market show a positive relationship between art price and S&P before 2013, and a strong negative relationship post 2013 (adjusted R^2 of 0.36 and 0.33, respectively). Furthermore, the low liquidity of the art market is captured in the lag effect on the regression analysis using the Ordinary Leased Squares (OLI) methodology.

FIGURE 6: Artprice index and S&P industrial index showing performance of respective markets from first quarter 1998 to final quarter 2016.



Source: Derived from Artprice.com (2017), and Reuters (2017), Quantec (2017)

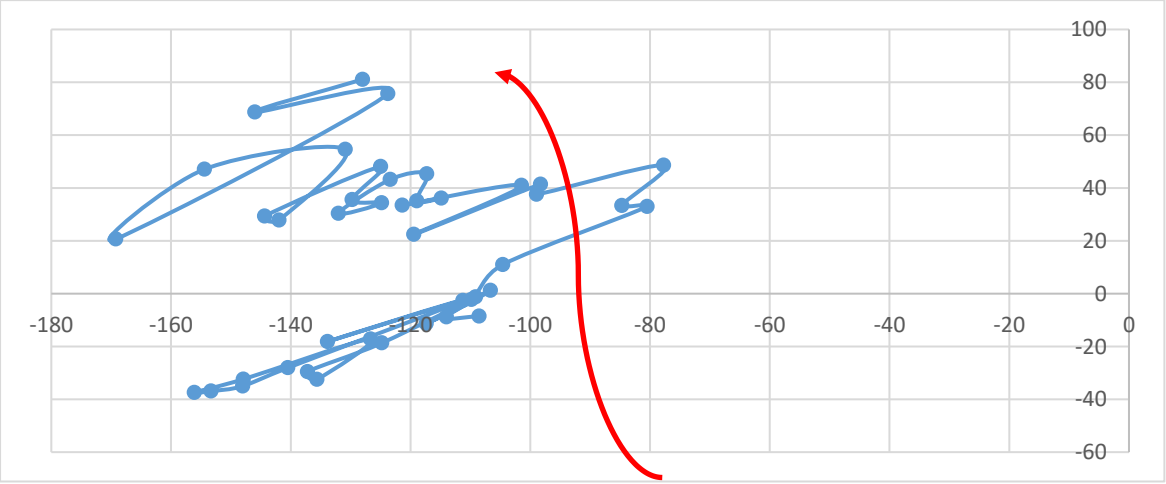
Regarding the movement between commodities and equities, the relationship was similar to that of the Artprice index, with a slightly stronger adjusted R^2 values of (+) 0.6 and a (-) 0.5 before and after 2013 respectively. By repeating this data analysis between Artprice index and commodities index, before and after 2013, the market show a very strong structural shift, adjusted R^2 of 0.87 and 0.80, respectively, indicating a change in market behaviour, and the corresponding downward movement in art market performance. Using an OLS regression analysis of Artprice index, and commodities, it appears that commodities themselves include within them the impact

of market volatility as well as capturing the 2008 financial crisis. Despite the usual volatility, the prices of commodities spiked in 2008 and then spiked again in 2012.

It was at both of these times that saw the start of another downward cycle for the art market, indicated by a drop in the performance of the Artprice index, both post 2008 and post 2012. In effect, considering the effect of commodities (t = 18.67) and by lagging the S&P index by four quarters (t = 3.58), and taking into account the impact of the 2008 financial crisis (t = -3.2), and accounting for spikes in the commodity index (t = 2.79), the data analysis indicated an adjusted R^2 value of 0.91, implying that the impact of commodity spikes does have an impact on the structural change in the Artprice index (Baur, 2017).

Using the two major structural breaks that are identified in Baur (2017), namely, 1998 to 2008, 2008 to 2013, and 2013 to 2017, and applying the theory of Tobin, the following relationships highlighted in figures 7 to 9 become apparent.

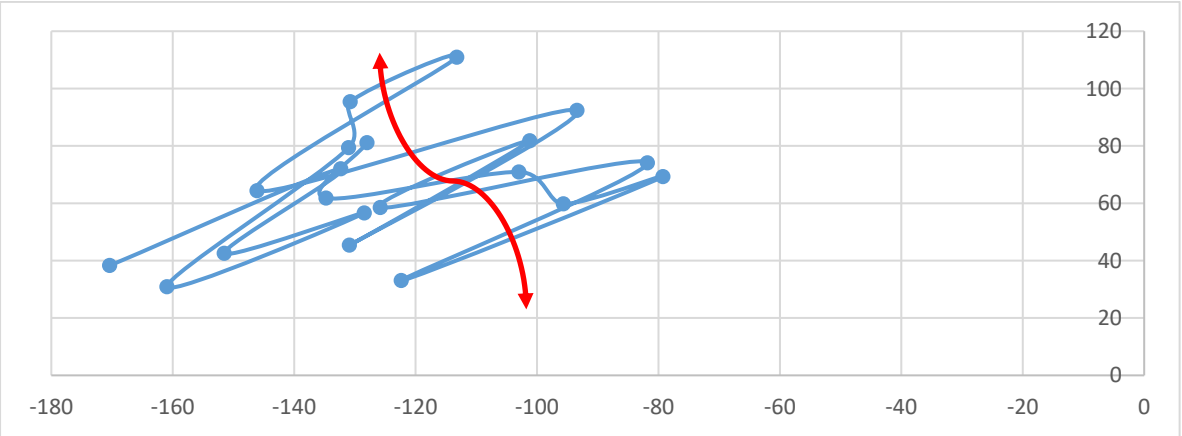
FIGURE 7: Deriving the changing relationship of risk and return for investors between 1998 and 2008.



Source: Derived from Artprice.com (2017), and Reuters (2017)

During the period 1998 to 2008, the slope of Tobin moved upwards. See figure 5. It was during this phase that the market for 'Fine Art' appeared to be less volatile than the market for other assets, measured here as the S&P 500. It was during this phase that the art market was becoming recognised as an alternative investment for portfolios.

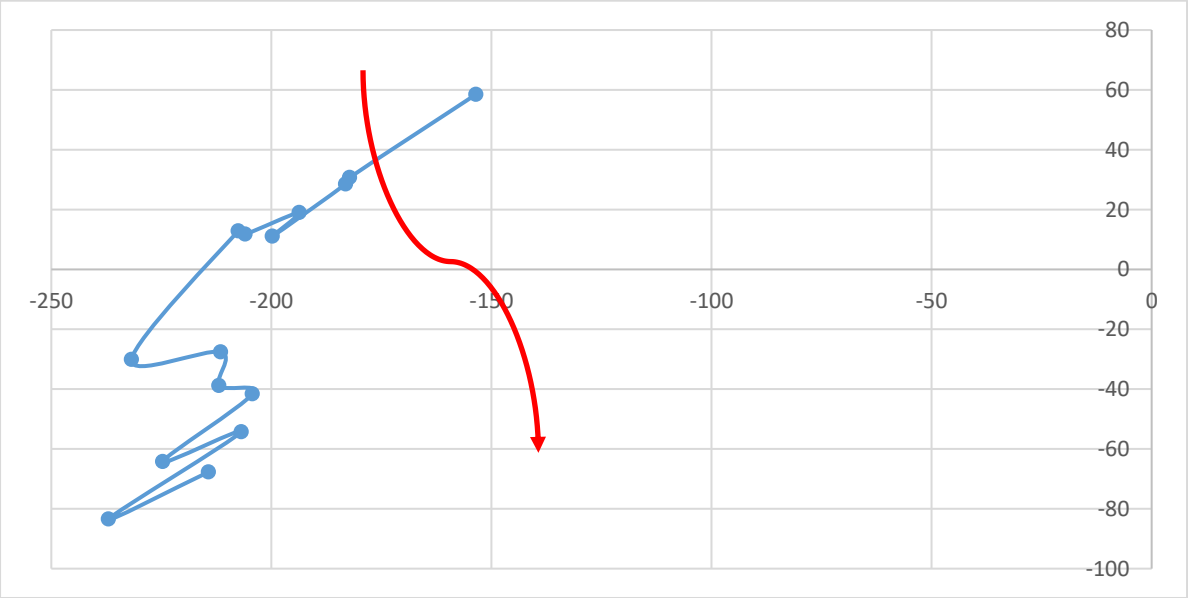
FIGURE 8: Deriving the changing relationship of risk and return for investors from 2008 to 2013.



Source: Derived from Artprice.com (2017), and Reuters (2017)

From the period 2008 to 2013, in figure 8, the slope of Tobin moves in both upwards and downwards. It was during this phase that the market for 'Fine Art' appeared to be a lot more volatile post the 2008 financial crisis (which represents the first structural break). During this phase, the market for art appeared to outperform the S&P 500, but represented much higher levels of volatility.

FIGURE 9: Deriving the changing relationship of risk and return for investors from 2013 to 2017.



Source: Derived from Artprice.com (2017), and Reuters (2017)

From the period 2013 to 2017, as indicated by figure 9, the slope of Tobin moves strongly downwards. It was during this phase that investments in the art market were underperforming against the S&P 500. The relationship between the S&P 500 and the Artprice index is shown earlier in figure 6.

Putting practice into theory

Looking at figure 10, and beginning with Graph A, the relationship between the expected return and uncertainty is shown as the 'Value of Information'. The 'Value of Information' has a positive slope as shown earlier in figure 5. An increase in the degree of uncertainty will have a positive relationship with the expected returns. If returns are expected to be higher, associated with higher risk, then there will be an increase in the ‘value’ of the information. This could be associated with the need to hedge against that risk. Graph B shows the respective distribution of information between the Private and the Public Sector. A higher uncertainty regarding art or an artist will increase the demand for additional information relating to that artist or art.

The cost associated with holding information by the institution begins to rise, forcing the information to move from the private (institution) into the public (market) domain. This is shown as a swivel of the cost of information curve from Y_2X_2 to Y_1X_1, and a shift from A_1 to B_1 on the information isoquant of Graph B. The increase in information in Graph B is accompanied by an increase in the overall supply of art in the art market from S_{i1} to S_{i1^*}, or a corresponding change in equilibrium of C_1 to E_1 on Graph C. At C_1 on Graph C, the expected returns are higher indicated by P_{i1} on Graph C.

This was made possible by the limited supply of information at point A_1 on Graph B. As the available information increases through an increase in the demand for information, it forced the

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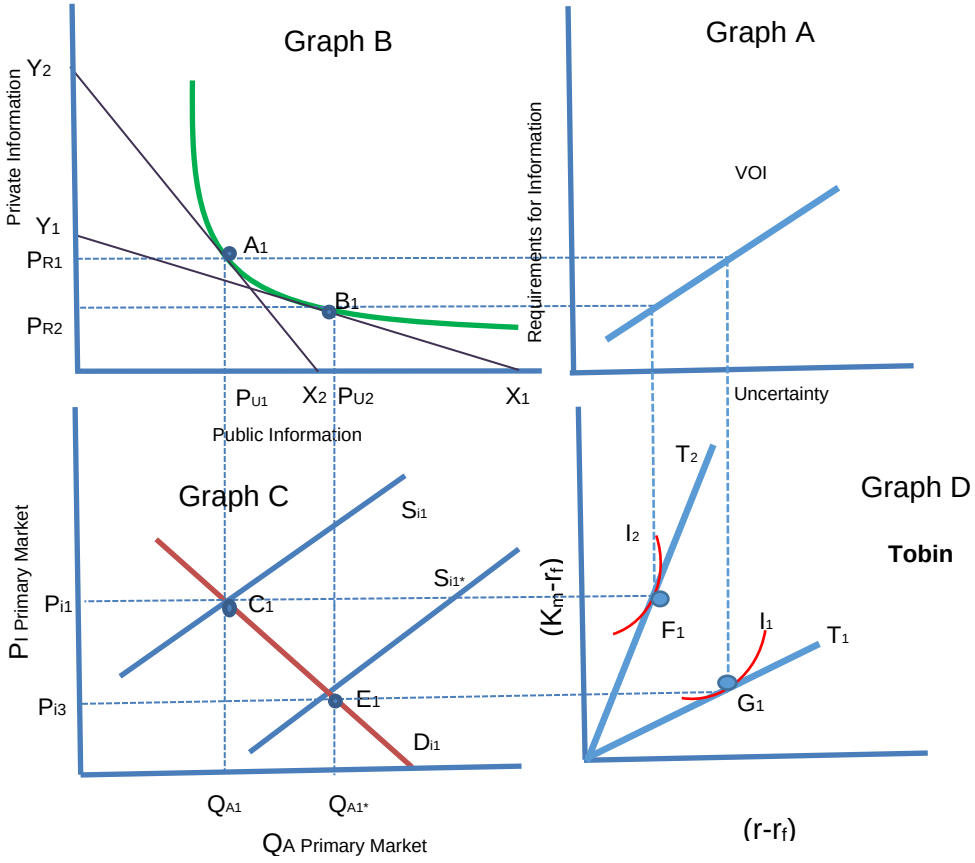
price of art in the primary art market to decrease to P_{i3} on graph C. The decrease in prices in the art market reduced the confidence of investors by showing lower returns to their investment.

These lower returns caused the corresponding Tobin relationship to move from F_1 to G_1 on Graph D. The move from F_1 to G_1 is indicated by an increase in uncertainty ($r-r_f$) and a decrease in expected returns (K_m-r_f). The market index for art begins to show lower returns compared to the comparative indices (S&P 500). This causes an increase in uncertainty, portfolios begin to adjust with the changing expectations, and the 'Value of Information' begins to increase, resulting in a new search for information in Graph A.

FIGURE 10: Impact of changing supply factors in the market for 'Fine Art' and the impact on Tobin.



Increasing supply of 'Fine Art' Post 2013

Baur (2017) mentions that the number of sales in art rose in 2016 by 3.2%, while sales turnover dropped by 25%, almost entirely due to a lower prices for major masterpieces (works priced over $10 million). Compared to the 2015 art market performance, London art markets dropped 30% and New York art markets dropped 49%. However, China's art market is still experiencing significant reformation (a new market regulation pertaining to 'Fine Art' was introduced in early 2016 so as to standardize China's domestic art market and to regulate trading behaviour while protect the rights and interests of the artists, sellers, and consumers. China's overall unsold rate was at 64% while its total turnover increased by 18%. Stock markets around the globe where particularly volatile post 2013 and the market for hedge funds fell considerably. Many of the new art investments that had previously driven the global art market prior to 2013 begun to diminish.

Conclusion

There is nothing homogenous about art which is a product of creativity and innovation, and value art may be hidden far beneath the intrinsic factors that it is constructed from. Limiting the value of art to its mere potential of holding its value for resale at a later date is rather overambitious for any person attempting to try and determine a value for the 'Fine Art' being traded. Considering the aesthetics of Fine Art, without further consideration of the emotional, psychological and cultural factors of the respective investors, is only one small part of the entire analysis.

Naturally, investors wish to hold an asset for favourable future returns, and the decision that an investor makes is dependent on the information that they are able to derive from the markets, but as the market is typically inefficient. The level of inefficiency could be broadened still further due to a lack of sufficient information regarding the investment by the investor into the market for 'Fine Art', creating a rather uncertain environment in which to trade.

Within the market, the level of uncertainty creates a value of its own. Markets can co-ordinate information flows, and create means of co-operation between members of the primary market by using this uncertainty in a strategic way, in order to derive excessive profits. There exists political and social motives for such co-ordination, but with the aim of maintaining higher value for the investments been traded within the inefficient market environment. Where strategic uncertainty creates opportunities, it also has the potential of undermining the market by making it extremely difficult to offset for risk. Many organisations, the likes of Mei & Moses and Artprice set regular index figures by processing auction set data from major auction houses, such as Christies and Sotheby's, with which to create a measure against the overall market. These indexes are not necessarily reliable, making derivative trading near impossible to establish and making risk instruments difficult to quantify.

Using the CAPM methodology, and distinguishing structural breaks in the data, defines how the 'Value of Information' relating to the market for 'Fine Art' is central to any study of the Art market. Without a thorough investigation into how the role that this information plays and the strategic significance through the political co-ordination of such information, it is near impossible to understand the relationship that exists between the primary and the secondary art market. Information holds value and this 'Value of Information' is significant in prices setting and determining investor returns. Institutions control this information. The control of this information may be the reason why some artists are promoted while others are not. The development of art price indices are often a blanket used to camouflage the institutions hold over such information. As long as there is a blanket hiding from view the real value of art, the investor and the institution may gain excessive profits, which is at the expense of the artist who is trying to survive or earn his or her 'dry crust of bread'.

The growth of information technology and the use of the internet to distribute increasing volumes of information, has allowed the market to experience an increase in the supply of art. This benefits the market and frees the artist from the claws of the institution. This may mean lower returns for the few 'privileged artists'. However, as a whole, it may mean greater future prosperity for the art world.

References

Aberg, C. J. (2015). Forecasts , Uncertainty and Decision-Making. *The Swedish Journal of Economics,* 69(4), 248-262.

Artprice.com, (2017). *Artprice Global Indices.* s.l.:Artprice.com.

Baur, P. (2014). Inefficiency in the market for 'Fine Art': how this market inefficiency promotes 'Art Tourism' in South Africa. *African Journal of Hospitality,* 1-18.

Baur, P. (2017). Art, for leisure or profit : an analysis of the movement of investment from equities into the ' Fine Art ' market. *African Journal of Hospitality, Tourism and Leisure,* 6(2), 1-15.

Baur, P. W. & Els, G. (2014). Using a behavioural approach to analyse the suitability of cartoons as a vehicle for teaching and learning in finance. *African Journal of Hospitality, Tourism and Leisure,* 3(1), 1-14.

Cabrales, A., Miniact, R., Provesan, M. & Ponti, G. (2010). Social preferences and strategic uncertainty: An experiment on markets and contracts. *American Economic Review,* 100(5), 2261-2278.

Celarier, M. (2016). Why Investors Are Watching Sotheby's and the Art Market. *Fortune Finace*, 22 September.

Chao, H.-P. (1981). Exhaustable Resource Models: The Value of Information. *Operations research,* 29(5), 903-916.

Chevalier-Roignant, B., Flath, C., Huchzermeier, A. & Trigeorgis, L. (2011). Strategic investment under uncertainty: A synthesis. *European Journal of Operational Research,* 215(3), 639-650.

Claxton, K., Neumann, P. J., Araki, S. & Weinstein, M. C. (2001). BAYESIAN VALUE-OF-INFORMATION ANALYSIS An Application to a Policy Model of Alzheimer's Disease. *International Journal of Technology Assessment in Health Care,* 17(1), 38-55.

Cloud, J., Vincent, G. & Klien, P. A. (2016). *Art and Finace Report,* Luxembourg: Deloitte & ArtTactic Art.

Coffman, R. (1989). Art Investment and Asymetrical Information. 83-94.

Courtney, H., Kirkland, J. & Viguerie, P. (1997). Strategy Under Uncertainty. *Harvard Business Review,* 75(6), 67-79.

Cummans, J. (2015). *A Brief History of Commodity ETF Spikes.* [Online] Available at: http://etfdb.com/commodity-etfs/a-brief-history-of-commodity-etf-spikes/ [Accessed 19 03 2017].

Daniels, C. (2017). *Yorkton This Week.* [Online] Available at: - See more at: http://www.yorktonthisweek.com/agriculture/few-expectation-of-commodity-price-spike-1.9712448#sthash.SNGVDOSd.dpuf
[Accessed 19 March 2017].

Dean Jr, J. W. & Sharfman, M. P. (1996). Does Decision Process Matter? A Study of Strategic Decision-Making Process Effectiveness. *Academy of Management Journal,* 39(2), 368-396.

Dunn, S. P. (2001). Uncertainty, strategic decision-making and the essence of the modern corporation: Extending Cowling and Sugden. *The Manchester School,* 69(1), 31-41.

Eeckhoudt, L. & Godfroid, P. (1995). Risk Aversion and the Vaiue of Information. *Journal of Economic Education,* 382-389.

Ehrmann, T. (2016). *Art and Investment,* s.l.: Artprice.com.

Eisenhardt, K. M. & Zbaracki, M. J. (1992). Strategic Decision Making. *Strategic Management Journal,* Volume 13, 17-37.

Erdos, P. & Ormos, M. (2010). Random walk theory and the weak-form efficiency of the US art auction prices. *Journal of Banking and Finace,* Volume 34, 1062-1076.

Fitzsimmons, M. (2006). The Problem of Uncertainty in Strategic Planning. *Survival,* 48(4), 131-146.

Frey, B. S. & Cueni, R. (2013). *The Economists' Voice,* 10(1), 1-6.

Gompertz, W. (2016). *BBC News, Entertainment abd Arts: Geneva Free Port: The greatest art collection no-one can see.* [Online] Available at: http://www.bbc.com/news/entertainment-arts-38167501 [Accessed 20 March 2017].

Gordon, L. a. L. M. P. (2002). The economics of information security investment. *ACM Transactions on Information and System Security,* 5(4), 438-457.

Hsiao, J. S. C. (2005). Evaluating the value of information sharing in a supply chain using an ARIMA model. *The International Journal of Advanced Manufacturing Technology,* 27(5-6), 604-609.

Karmakar, D. (2016). *Economic Discussion.* [Online] Available at: http://www.economicsdiscussion.net/money/demand-for-money/tobins-portfolio-balance-approach-with-diagram-demand-for-money/16079 [Accessed 6/4/2017].

Lawrence, D. B. (1987). The assessment of the expected value of information in the binary decision model. *Managerial and Decision Economics,* 8(4), 301-306.

Lipshitz, R. & Strauss, O. (1997). Coping with Uncertainty: A Naturalistic Decision-Making Analysis. *Organizational Behavior and Human Decision Processes,* 69(2), 149-163.

Mei, J. (2005). *Vested Interest and Biased Price Estimates: Evidence from an Auction Market.* s.l.:s.n.

Mei, J. & Moses, M. (2004). Vested Interest and Biased Price. *The Journal of Finance,* Volume 1454.

Morris, S. & Shin, H. S. (2002). *Measuring Strategic Uncertainty.* s.l., Coordination, Incomplete Information and Iterated Dominance.

Oh, J., Yang, J. & Lee, S. (2012). Managing uncertainty to improve decision-making in NPD portfolio management with a fuzzy expert system. *Expert Systems with Applications,* 39(10), pp. 9868-9885.

Petterson, A.(2011). *Art & Finance Report 2011.,* s.l.: Deloitte & Arttactic.

Quantec, (2017). *EasyData,* s.l.: Quantec Research (Pty)Ltd.

Reuters, (2017). *S&P 500 1998-2017.* s.l.:Reuters.

Smit, H. & Trigeorgis, L.(2006). Real options and games: Competition, alliances and other applications of valuation and strategy. *Review of Financial Economics,* 15(2), 95-112.

Van der Merwe, E.J. & Mollentze, S. L. (2014). *Monetary Economics.* 2 ed. Southern Africa: Oxford University Press.

Yang, Z., Ewald, C. & Wang, W. (2011). A Comparative Analysis of the Value of Information in a Continuous Time Market Model with Partial Information: The Cases of Log-Utility and CRRA. *Journal of Probability and Statistics,* 1-23.