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Art Investment Funds and NFTs

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Abstract

Art price inflation, rising levels of wealth, and the artworld's financialization have changed the way investors view the art market. In an attempt to capture the momentous returns realized by successful collectors, art investment funds have emerged with the conviction art can be used as a speculative or strategic alternative asset. However, the majority of art funds have been dissolved or put on hold. This paper examines the investment characteristics of fine art to uncover the rationale for art investment fund failures, finding the art market's inefficiency as the foremost explanation. Subsequently, non-fungible token (NFT) art and collectibles – a new digital submarket of the artworld – are explored as an alternative to fine art investment. Through analysis and comparison of both fine art and NFT markets, this paper argues the NFT art and collectibles market is considerably more efficient, and therefore a more viable investment option than fine art for art investment funds.

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Introduction

Over the past 50 years, a confluence of art price inflation, increasing levels of wealth, and the artworld's financialization has changed the way investors view fine art. Now motivated by its potential returns, investors are increasingly treating fine art as a speculative or strategic alternative asset. Leveraging qualitative and quantitative proficiency as well as purchasing power, art investment funds (structured like private equity or hedge funds) have emerged to securitize fine art trading. However, few have been successful. This thesis will outline the rise of art as an investment and examine the art market's characteristics to determine the reasons art investment funds underperform. Subsequently, this thesis will examine the investment characteristics of art and collectibles in the form of non-fungible tokens (NFTs). **In the following chapters, I will show investment in the art and collectibles NFT markets is a more viable option than fine art investment for art investment funds.**

The primary objective of this study is to offer a solution to the issues faced by the art investment fund industry. In doing so, this thesis aims to further democratize the artworld, as successful art investment funds will enable greater opportunity for lay participants to enjoy the monetary benefits of investing in art.

While a significant amount of research exists on the investment characteristics of art, at the time this thesis is written there is limited published work endorsing the potential of NFTs to overcome the problems associated with investing in tangible art for art investment funds.

1 Overview of Art Investment Funds

1.1 The rise of art investment funds

Although considered by many as anathema to art, interest in the financial characteristics of the art market has been long-standing. Consider Giorgio Vasari's *Lives of Artists* – a 15th century series outlining the artworld of Renaissance Italy, including details on the art market's competition, demand, and prices.[1] Further, analysis of the relationship between art and money was important for the functioning of global art trade in Renaissance Italy, 17th-century Amsterdam, 18th century Paris, and 19th century London.[2] However, it was not until the 20th century the notion of art as a viable alternative asset took hold.

This chapter summarizes the key events and trends of the 20th century referenced in the field of art investment research leading to the emergence of modern art investment funds in the United States.

1.1.1 Successful strategic art investment funds

The genesis of modern art investment can be traced to La Peau de L'Ours – a mutual art buying scheme established in 1904 by 13 French investors. [3] Over La Peau de L'Ours' 10-year life, the group invested 27,500 francs (approximately $100,000 today) in the avant-garde market, including works by Picasso and Matisse.[4] The collection's sale in March 1914 achieved a gross profit of 116,545 francs (equaling a

[1] Georgio Vasari, *Lives of Artists,* trans. George Bull (New York: Penguin, 1965);
Noah Horowitz, *Art of the Deal: Contemporary Art in a Global Financial Market* (New Jersey: Princeton University Press, 2011), 4.
[2] Zain Talyarkhan, "Hedging Risk in Fine Art Collateralization and Investment," (Master's thesis, Sotheby's Institute of Art, 2011), 2.
[3] La Peau de L'Ours translates to "The Skin of the Bear." This is reference to a tale written by Jean de la Fontaine, which claims one should "never sell the skin of the bear before you've actually killed it." In choosing this name, La Peau de L'Ours reveals they understood the risks inherent in art as an investment;
Erica Coslor, "Wall Streeting Art: The Construction of Artwork as an Alternative Investment and the Strange Rules of the Art Market," (PhD diss., University of Chicago, 2011), 34.
[4] Coslor, "Wall Streeting Art," 35.

compounded annual growth rate of 16%) and a net profit of 63,207 francs.[5] Unsurprisingly, the success of La Peau de L'Ours is repeatedly referenced by present-day art investors.[6]

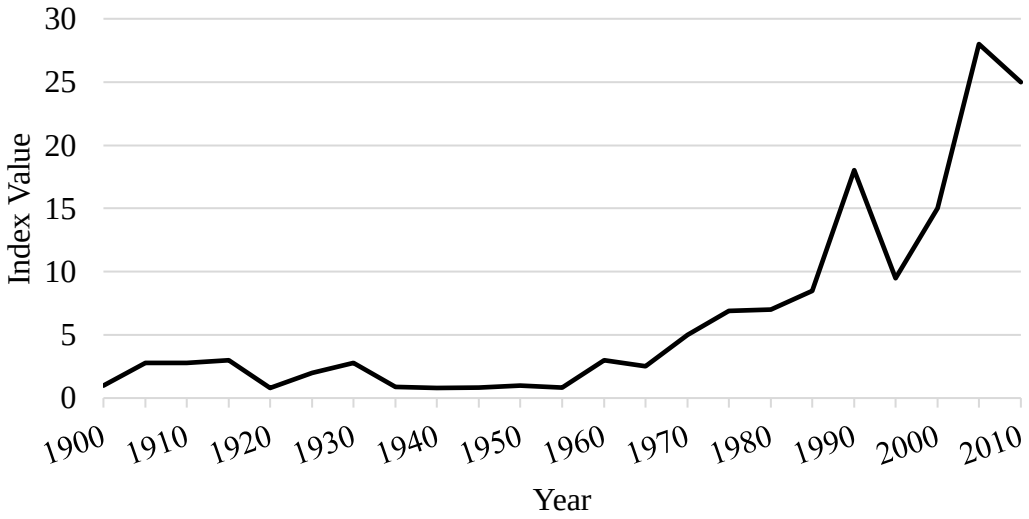
The British Rail Pension Fund (BRPF) is another universally recognized example of successful strategic art investment.[7] BRPF was the first institutional investment company to utilize art as an asset, allocating 2.9% of its retirement fund capital in the art market from 1974.[8] Former company secretary for the Railways Pension Trustee Company, Susan Adeane, claims the fund's objective was to supplement mainstream assets as a hedge against double-digit inflation – a consequence of the 1973 Oil Embargo.[9] Under the direction of Sotheby's, BRPF spent six years purchasing Old Masters and Impressionist paintings, Chinese porcelain, medieval art, books, sculpture, jewelry, and antiquities.[10] As inflation cooled, BRPF began selling its collection in 1987, and final liquidation of its art fund's assets occurred in 2000.[11] The cumulative cash internal rate of return for the fund equaled four percent per annum in real terms, outpacing inflation.[12] BRPF's success in achieving its objective affirmed the legitimacy of art as an asset for many

[5] Likely contributing to the success of La Peau de L'Ours' was its ability to purchase works directly from the artist. This is less possible in today's art market as artists are typically bound to exclusive consignor agreements with their art dealer.
Coslor, "Wall Streeting Art," 35.
[6] Coslor, "Wall Streeting Art," 36.
[7] Erica Coslor and Christophe Spaenjers, "Organizational and Epistemic Change: The Growth of the Art Investment Industry," *Academy of Management Proceedings* 2013, no. 1 (2013): 14.
[8] Coslor and Spaeniers, "Organizational and Epistemic Change," 14;
Marc Day, Giampiero Favato, and Raya Mamarbachi, "Art as an Alternative Investment Asset," (Essay, Henley Management College, 2020), 3.
[9] Coslor and Spaniers, "Organizational and Epistemic Change," 14;
Horowitz, *Art of the Deal*, 154.
[10] Day, Favato, and Mamarbachi, "Art as an Alternative Investment Asset," 3;
Horowitz, *Art of the Deal*, 154.
[11] Day, Favato, and Mamarbachi, "Art as an Alternative Investment Asset," 3;
Horowitz, *Art of the Deal*, 155.
[12] Horowitz, *Art of the Deal*, 155;

investors. However, it is often overlooked that despite BRPF meeting its objective, it underperformed relative to the major stock markets during its investment period.

1.1.2 Art price inflation

Figure 1: Value of art 1900-2010



Note: this figure shows index values in real GBP. The index is set equal to 1 at the beginning of 1900.[13]
Source: data from Suzanne Gyorgy et al., *The Global Art Market: Perspectives on Current Drivers and Future Trends* (New York: Citi Global Perspectives and Solutions, 2015): 31, figure 15.

Figure 1 illustrates the growth in art's value between 1900 and 2010. From the 1950s, prices for preferred art categories such as Impressionist and Old Masters were trending upward, and by the late 60s contemporary art sales began achieving momentous results.[14] Economists Bruno Frey and Werner Pommerehne argue the enormous prices realized at auctions during this time created the widespread belief art investment returns were in general very high.[15] In 1968, art critic Leo Steinberg noted "avant-garde art, lately Americanized, is for the first time associated with big

[13] Suzanne Gyorgy et al., *The Global Art Market: Perspectives on Current Drivers and Future Trends*, (New York: Citi Global Perspectives and Solutions, 2015): 31.
[14] Coslor, "Wall Streeting Art," 32.
[15] Bruno Frey and Werner Pommerehne, "Art Investment: An Empirical Inquiry," *Southern Economic Journal* 56, no. 2 (1989): 396.

money…. For far-out modernism, we can now read "speculative growth stock"; for apparent quality, "market attractiveness"; and for an adverse change of taste, "technical obsolescence."… Another decade and we shall have mutual funds based on securities in the form of pictures held in bank vaults."[16]

The 'Scull Sale' of 1973 represents the advent of "superprices" – a term describing the extraordinary numbers achieved at auction strengthening the perception art is a lucrative asset. At Sotheby's Parke Bernet, famous American art collector Robert Scull auctioned off 50 works – including paintings by Robert Rauschenberg, Franz Kline, and Andy Warhol – for $2.2 million (approximately $14.8 million in 2022).[17] To economic sociologist Erica Coslor, this unprecedented result is considered a "break from past patterns in the art market," as contemporary art by living artists became "an area of high monetary value along with older, proven genres."[18] The Scull Sale is recognized by industry professionals as a pivotal moment for the art market, which strengthened the view art is a "commodity or investment market."[19]

1.1.3 The financialization of the artworld

The artworld's financialization was facilitated by the adoption of financial tools and measures to analyze and quantify the investment characteristics of art. From the 1950s onwards, academics began publishing books to convey the investment potential of the art market - for example, Richard Rush's *Art as an Investment*.[20] Between 1967 to 1971, the (London) Times published the first index to track art

[16] Leo Steinberg, *Other Criteria: Confrontations with Twentieth Century Art* (New York: Oxford University Press, 1972), 65.
[17] Coslor, "Wall Streeting Art," 25-26.
[18] Coslor, "Wall Streeting Art," 25.
[19] Olav Velthius, *Talking Prices: Symbolic Meanings of Prices on the Market for Contemporary Art* (Princeton: Princeton University Press, 2005), 142.
[20] Richard Rush, *Art as an Investment* (New Jersey: Englewood Cliffs, N.J., Prentice-Hall, 1961). Coslor and Spaniers, "Organizational and Epistemic Change," 12.

prices – the Times-Sotheby art price index.[21] Typically, financial indices tracked the performance of conventional assets – for example, the Standard and Poor's 500 (S&P500) follows the performance of the 500 largest companies in the U.S. The development of the Times-Sotheby art index allowed art to be charted alongside stocks and bonds.[22]

Journalistic art market research ignited further growth in art investment literature toward the end of the 20th century, such as academic John Stein's 1977 article "The Monetary Appreciation of Paintings," detailing the use of art price data to purchase art; and economist William Baumol's contentious 1986 article "Unnatural Value: Or Art Investment as Floating Crap Game."[23]

Moreover, the development of financial theories – such as Markowitz's Modern Portfolio Theory (MPT) in 1952 – highlighted the importance of diversification among uncorrelated asset classes to minimize portfolio risk, ultimately raising interest in the use of art as an investment. For example, BRPF based its selection of an art fund on this rationale.[24]

The financialization of the artworld was also nourished by the adoption of art advisory services by financial institutions. This is supported by Frey and economist Reiner Eichenberger, who state "banks have recently strengthened this trend toward 'art as an investment' by employing 'art investment counsellors,' thus suggesting that

[21] Coslor, "Wall Streeting Art," 34.
[22] Coslor and Spaniers, "Organizational and Epistemic Change," 13-21.
[23] Kaitlin Leigh Serota, "Art & Cultural Capital: The Economics of Art Investment," (Master's thesis, Dartmouth College, 2017), 88;
Rachel Campbell, "Art as a Financial Investment," *The Journal of Alternative Investments* 10, no. 4 (2008), 65;
John P. Stein, "The Monetary Appreciation of Paintings," *Journal of Political Economy* 85, no. 5 (1977);
William J. Baumol, "Unnatural Value: Or Art Investment as Floating Crap Game," *American Economic Review* 76, no. 2 (May 1986).
[24] Coslor and Spaeniers, "Organizational and Epistemic Change," 17.

it is a financially rewarding activity to engage in."[25] Citibank established the first institutional bank Art Advisory Service in 1979, followed by other large competitors including Chase Manhattan, Credit Suisse, Deutsche Bank, UBS, and Bank of America.[26] Typically, the objective of a bank's art advisory service is to retain or attract high net-worth art-collecting clients who can utilize a range of the bank's services, such as wealth management.[27]

In addition, the rise of art-secured lending has propelled the perception art is a viable financial tool and has acted as a catalyst for the growth in art investment funds.[28] Art-secured lending is a credit service offered by commercial and private banks, boutique asset-based lenders, and auction houses, targeting high net-worth individuals (HNWI) who seek to unlock liquidity from their collection by taking a loan against their art. In some cases, art funds offer shares in a portfolio of art-secured loans, such as Yieldstreet's Athena Art Finance, which is discussed in section 1.2 below.

Table 1: Art lending institutions and providers 2022 (non-exhaustive list)

Type of institution	**Example of provider**
Commercial and private banks	Citi Private Bank
	Deutsche Bank
	Goldman Sachs
	JP Morgan
	Morgan Stanley
	Bank of America
Boutique asset-based lenders	Yieldstreet (Athena)
	Fine Art Group
	Art Finance Partners
Auction house finance	Sotheby's
	Phillips
	Christie's

[25] Bruno Frey and Reiner Eichenberger, "On the Return of Art Investment Return Analyses*," Journal of Cultural Economics* 19, no. 3 (1995): 207.
[26] Horowitz, *Art of the Deal*, 159.
[27] Horowitz, *Art of the Deal*, 159.
[28] Horowitz, *Art of the Deal*, 159.

Source: data from Anders Petterson and Adriano Picinati di Torcello, *Art and Finance Report 2021 7th Edition* (Luxembourg: Deloitte Private, 2021), 196, table 25, https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/financial-services/artandfinance/lu-art-finance-report-2021.pdf.

Increasingly available auction price data, along with the growth of art market subscription services publishing sales information (such as Artnet and artprice), has accelerated the financialization of the artworld. Artnet founder Hans Neuendorf states "why should perfectly normal standard rules and use of information in any market – be it real estate or be it the stock exchange … not apply for the art market?"[29] These services provide greater transparency in the art market and enable improved quantitative and qualitative analysis for investment decisions.

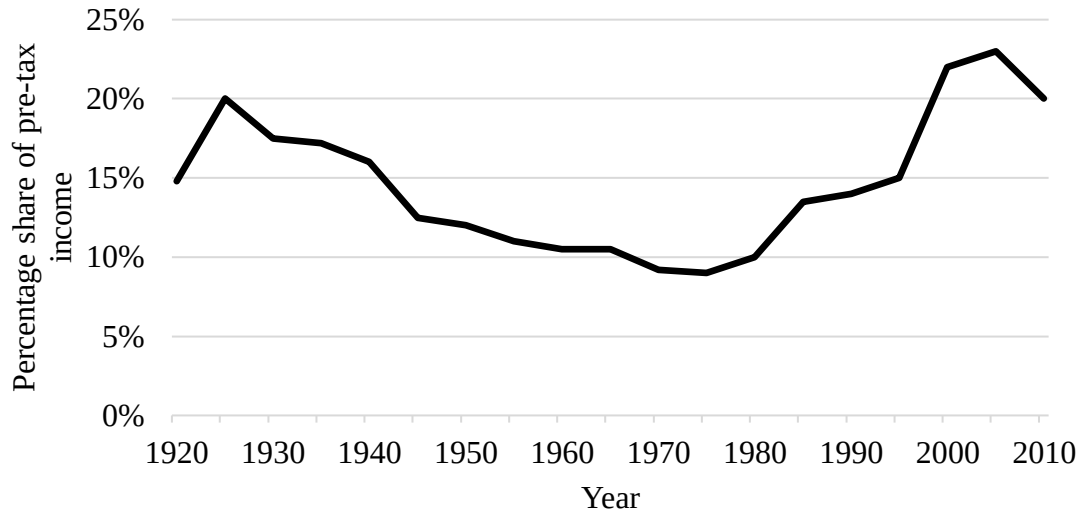
1.1.4 Rising levels of wealth and the increasing popularity of alternative investments

Figure 2 shows income concentration for the top one percent of wealthiest households in the U.S. has increased considerably since the 1970s.[30] As the U.S. financial elite became wealthier, the demand for alternative assets and luxury goods increased. This led to considerable growth in alternative investment vehicles towards the end of the 20th century, such as hedge funds, real estate investment trusts (REITs), and private equity (PE).[31] Art investment funds stood to benefit from this, as many consider themselves structured similarly to PE or hedge funds.[32] This is supported by Fernwood (a recent art investment fund), which explicitly mentions in the fund's business plan high net-worth retail investors are the target clientele.[33]

[29] Coslor and Spaeniers, "Organizational and Epistemic Change," 20.
[30] "Income Concentration at the Top Has Risen Sharply Since the 1970s," Center on Budget and Policy Priorities, last modified January 13, 2020, https://www.cbpp.org/income-concentration-at-the-top-has-risen-sharply-since-the-1970s-4.
[31] Horowitz, *Art of the Deal,* 162.
[32] Horowitz, *Art of the Deal,* 162.
[33] "Executive Summary," Fernwood, accessed July 28, 2022, https://fernwoodarchive.com/executive-summary.html.

Additionally, growing wealth levels reflect the timeline for the rising popularity of art-investment literature and journalism mentioned above.

Figure 2: Share of total pre-tax income earned by top one percent households 1920-2010 U.S.



Source: data from Center on Budget and Policy Priorities, "Income Concentration at the Top Has Risen Sharply Since the 1970s," last modified January 13, 2020, https://www.cbpp.org/income-concentration-at-the-top-has-risen-sharply-since-the-1970s-4.

1.2 Modern-day art investment funds

1.2.1 Structure and objectives

Today's art investment companies securitize art by offering investors shares in a fund providing exposure to the art market. The structure of an art fund is typically similar to PE or a hedge fund.[34] Like other assets, the basic principle behind art investment is simple: buy low, sell high, and outperform friction costs associated with holding an artwork. This is considered achievable through a "buy and hold" strategy, or exploiting the art market's inefficiencies, such as its opacity, global price discrepancies, and information asymmetry. Often art investment funds also aim to capitalize on art's weak correlation with conventional assets (this correlation is

[34] Horowitz, *Art of the Deal*, 149.

contested among academics) to offer a hedge against inflation, for example, BRPF. These concepts will be explained further in Chapter 2. This section will outline the two most common art fund structures, using examples of existing art funds.

a. Hedge funds

Hedge funds are limited partnerships using pooled funds to invest in relatively liquid assets. They are managed by professional fund managers who focus on portfolio construction and risk management to create returns for partners. Often, hedge fund managers aim to create a portfolio of uncorrelated assets. This strategy was first proposed as part of MPT which suggests diversifying across a range of assets with low correlation of returns to reduce exposure to idiosyncratic risk in an overall portfolio.[35] Mimicking this strategy, art funds often aim to invest in a large portfolio of artworks or art-related assets, spreading across different artists, movements, creation dates, styles, or countries.

Like hedge funds, most art investment funds lock the investor's capital in the fund until a specified date (i.e., quarterly) or the end of the fund's term.[36] During this time, managers aim to achieve net returns of 10-15% per annum.[37] Similar to hedge funds, art investment funds typically charge a management fee from committed capital and a performance fee on profit. Albeit, cash flows are not limited to these charges as art funds can rent out the portfolio's works to investors or exhibitions.[38] Most art funds employ a hierarchical management structure, with the investment committee, management, and advisors at the apex.[39] Gallerists, dealers, and ex-auction house specialists typically execute the fund's trades, as they have superior market

[35] Harry Markowitz, "Portfolio Selection," *The Journal of Finance* 7, no. 1 (March 1952): 77–91.
[36] Horowitz, *Art of the Deal*, 149.
[37] Horowitz, *Art of the Deal*, 149.
[38] Horowitz, *Art of the Deal*, 150.
[39] Horowitz, *Art of the Deal*, 150.

knowledge and contacts.[40] Unlike administrative support employees, buyers receive a commission for finding artworks for the fund.[41] Art advisors can also be involved in intermediating between buyers and management.[42]

In January of 2022, Yieldstreet's Athena Art Finance launched its thematic 'Art Equity Fund II,' which is expected to hold between 10 and 20 artworks by artists from New York City's Harlem.[43] The fund's investment strategy is focused on growth and diversification, with a targeted annual net return of 13-17%.[44] To assess performance throughout the five-year investment period, re-appraisals are undertaken bi-annually and updates are provided to investors.[45] Athena charges a management fee of two percent per annum and an incentive fee of 15% of profits.[46] Investors are required to contribute between $10,000 and $1 million.[47] As of June 2022, the fund's size is $7.2 million inclusive of assets.[48]

b. Private equity

Alternatively, art funds can be structured similarly to PE. PE refers to investment funds that purchase companies within the private market (i.e., not available for purchase on public stock exchanges) organized as a limited partnership. Typically, PE funds build a portfolio by investing in companies they consider undervalued, or companies expected to appreciate with expansion or restructuring. Investment horizons are generally 10 years. Like PE, many art funds focus investment

[40] Horowitz, *Art of the Deal*, 150.
[41] Horowitz, *Art of the Deal*, 150.
[42] Horowitz, *Art of the Deal*, 150.
[43] "Art Equity Fund II – June 2022," Art Equity Fund II, Yieldstreet, accessed August 15, 2022, https://cdn2.yieldstreet.com/wp-content/uploads/2022/06/20155759/Art-Equity-Fund-II-June-2022.pdf.
[44] Yieldstreet, "Art Equity Fund II – June 2022."
[45] Yieldstreet, "Art Equity Fund II – June 2022."
[46] "Art Equity Fund II," Yieldstreet, accessed August 12, 2022, https://www.yieldstreet.com/offering/OiKSnA/art-equity-fund-ii/.
[47] Yieldstreet, "Art Equity Fund II."
[48] Yieldstreet, "Art Equity Fund II – June 2022."

strategy on purchasing undervalued artworks, aiming to realize strong, positive returns for investors by the end of the investment period.

An example is Masterworks – an art investment platform offering shares in individual artworks.[49] Like PE funds, Masterworks focuses on the appreciation of a single asset – as opposed to Athena's strategy of portfolio diversification. Investors can hold shares for the full investment horizon (targeted at three to 10 years) or can sell purchased shares on the Masterworks secondary market.[50] Masterworks charges a management fee of 1.5% per year of capital invested, and 20% of any future profits realized.[51]

1.2.2 Performance

In his research, art historian Noah Horowitz finds most art funds studied have been dissolved or put on hold. This includes the China Fund, several funds proposed by Société Générale Asset Management, The Art Trading Fund, Meridian Art Partners, the Art Dealer Fund by MutualArt, The Osian's Art Fund, Dean Art Investments, and ArtPlus (among many others).[52] Co-founder of Meridian Art Partners, Andrew Littlejohn, believes "the major problem with art funds is liquidity and transparency."[53] This is supported by Coslor, who asserts a key challenge for art funds is the market's opacity.[54] This subsection provides examples to highlight the key reasons art funds have historically failed or reportedly succeeded. It is important to note that because hedge funds are exempt from registering with the Securities and

[49] Masterworks files each artwork they acquire through the SEC as a public offering, allowing offering of shares to the public.
[50] "Masterworks," Masterworks, accessed August 5, 2022, https://www.masterworks.io/.
[51] "How it works," Masterworks, accessed August 5, 2022, https://www.masterworks.io/about/how-it-works.
[52] Horowitz, *Art of the Deal*, 184.
[53] Horowitz, *Art of the Deal*, 185.
[54] Coslor, "Wall Streeting Art," 193.

Exchange Commission (SEC), they are not required to report performance.[55] As Horowitz correctly points out, this often results in survivorship bias – "the most successful funds publicize returns while those that perform poorly, or fail, proceed undocumented… one suspects that the success of a few such businesses may overshadow the industry's more humble aggregate profile."[56]

a. Chase Art Fund

In 1989, Chase Manhattan Bank sought to raise $300 million from institutional pension funds for a five-year art fund.[57] It comes as no surprise banks began showing interest in art as an alternative asset, as five years before the fund's inception the Sotheby's Art Index had reported a compounded annual rate of return of 19%.[58] This was to be the first art fund organized by a bank to use pension fund money for art investment.[59] The Chase Art Fund required minimum investments of $10 million and aimed to diversify by purchasing "museum quality" works valued between $1 million and $10 million.[60] The fund's strategy was based on capturing the spread between wholesale and retail art prices, rather than relying on artwork appreciation.[61] This would be achieved through partnering with major art dealers, who had historically set markups as high as 200%.[62] However, at the time, corporate and public pension funds were less interested in hard asset investments, but instead focused on liquid markets such as equities and bonds.[63] Consequently, Chase failed to convince pension fund executives to invest in the fund.[64] In reference to the Chase Art Fund, Larry Davanzo,

[55] Horowitz, *Art of the Deal*, 164.
[56] Horowitz, *Art of the Deal*, 164.
[57] Anise C. Wallace, "Chase Fund to Invest in Artworks," *The New York Times*, February 20, 1989, https://www.nytimes.com/1989/02/20/business/chase-fund-to-invest-in-artworks.html.
[58] Wallace, "Chase Fund to Invest in Artworks."
[59] Wallace, "Chase Fund to Invest in Artworks."
[60] Wallace, "Chase Fund to Invest in Artworks."
[61] Wallace, "Chase Fund to Invest in Artworks."
[62] Wallace, "Chase Fund to Invest in Artworks."
[63] Wallace, "Chase Fund to Invest in Artworks."
[64] Horowitz, *Art of the Deal*, 156.

a partner at pension-fund investment consulting firm Wilshire Associates asserted "never once have we been asked about art by any of our clients."[65] This suggests a lack of interest and demand for art as an alternative investment tool.

b. Fernwood

Fernwood was founded in 2002 by former financial consultant Bruce Taub in the belief the art market's inefficiencies "provides numerous opportunities for a relatively small number of market insiders to identify and capture attractive opportunities with substantial potential."[66] For four years, a team of 20 professionals from the finance and art industry, including auctioneers, dealers, economists, and art critics, planned to build and actively manage Fernwood's funds. One example is Fernwood's 'Sector Allocation Fund' – eight movement-specific portfolios ranging from Old Masters to Emerging Masters.[67] The Sector Allocation Fund was created to exploit the art market's inefficiencies through active management of a broadly diversified art portfolio to realize attractive capital appreciation.[68] According to Fernwood, each of the eight sectors within the fund had distinct performance attributes, allowing for diversification benefits. [69] Fernwood aimed to raise $150 million.[70]

By 2006 – weeks before it was set to close on an initial tranche of $25 million – Fernwood shut down without notice.[71] Fernwood's CFO Michael Plummer explains he was concerned by Taub's ability to manage the funds, as Plummer had "studied the macro-economics of the art world for 10 years," and believed it was "still run by a

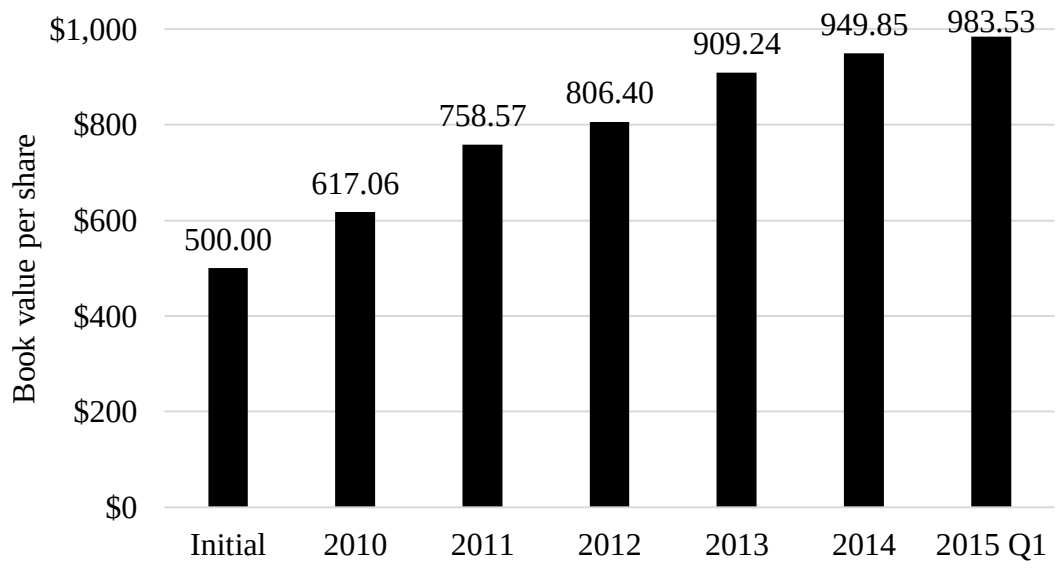
[65] Wallace, "Chase Fund to Invest in Artworks."
[66] "Investment Products," Fernwood Archive, accessed August 18, 2022, https://fernwoodarchive.com/investment-products.html.
[67] Horowitz, *Art of the Deal*, 144;
"Introduction," Fernwood Archive, accessed August 16, 2022, https://fernwoodarchive.com/introduction.html.
[68] Fernwood Archive, "Investment Products."
[69] Fernwood Archive, "Investment Products."
[70] Horowitz, *Art of the Deal*, 144.
[71] Horowitz, *Art of the Deal*, 180.

small group of insiders. And there is a lack of capital because of that."[72] Undoubtedly, considerable insider knowledge is required to combat information asymmetry within the art investment industry. Without sufficient expertise and contacts, funds will not gain the trust of potential investors. Fernwood was likely unable to convince potential investors of its prospects and access to insider information as it was a newly established company run by an ex-financial consultant.

c. Artemundi Global Art Fund

Art services company Artemundi (founded in 1989) ran its 'Global Fund' between 2010 and 2015.[73] Artemundi reports an impressive net return of 85.4% and an average net annual return of 17.1%.[74]

Figure 3: Artemundi Global Art Fund book value per share 2010-2015



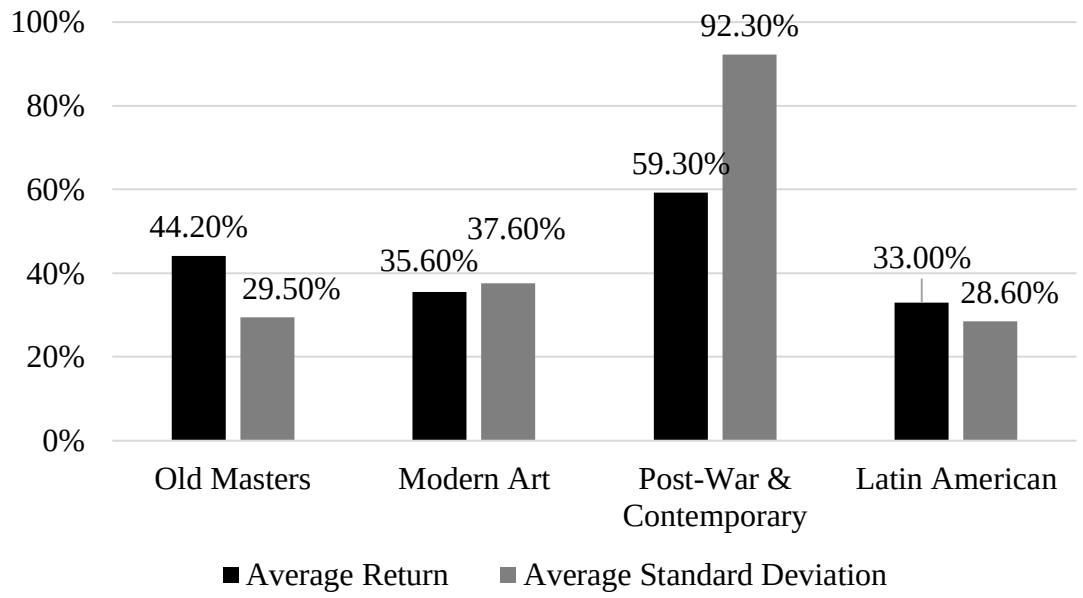
Source: data from Artemundi Global Fund, "Financials," Artemundi Global Fund, accessed August 11, 2022, https://artemundiglobalfund.com/financials/.

As shown above in Figure 3, Artemundi's book value per share increased from $500 in 2010 to $983.5 in the first quarter of 2015. Artemundi claims performance is

[72] Horowitz, *Art of the Deal,* 181.
[73] "Financials," Artemundi Global Fund, accessed August 11, 2022, https://artemundiglobalfund.com/financials/.
[74] Artemundi Global Fund, "Financials."

a result of the firm's "institutional character and reputation in the industry" which has "garnered significant negotiation power to purchase artworks at a competitive discount."[75] This enabled Artemundi to acquire artworks at an average of 11% below the fair market value (FMV).[76] Additionally, Artemundi achieved high returns by avoiding large transaction costs through only engaging in private sales, as auction houses typically charge 25% in commission fees.[77]

Figure 4: Artemundi Global Art Fund portfolio performance 2010-2015



Source: data from Artemundi Global Fund, "Financials," Artemundi Global Fund, accessed August 11, 2022, https://artemundiglobalfund.com/financials/.

Figure 4 illustrates the performance of each sector within Artemundi's portfolio. The largest gross returns were realized by Post-War & Contemporary art at 92.3%. This category also carried the greatest risk, with an average standard deviation of 59.3%. As a result, Post-War & Contemporary art only constituted 1.2% of Artemundi's overall portfolio value.[78] According to Artemundi, "the optimal share of

[75] Artemundi Global Fund, "Financials."
[76] Artemundi Global Fund, "Financials."
[77] Artemundi Global Fund, "Financials."
[78] Artemundi Global Fund, "Financials."

each art category is weighted according to current market tendencies by analyzing diverse sources of qualified information and industry acumen."[79] Despite its relatively lower average returns, Latin-American Art represented the greatest portion of Artemundi's portfolio at 45.2%. This sector was regarded during the investment period to be low-risk and frequently undervalued.[80] This level of market expertise allowed Artemundi to take advantage of the market's information asymmetry.

As demonstrated by Artemundi, information asymmetry and market inefficiencies can be used for strategic investment in the art market. However, it is only beneficial if the fund managers have considerable market experience, knowledge, insider information, and contacts. Otherwise, market inefficiencies and information asymmetry can present a major threat to capital raising and performance.

d. Athena Post-War and Contemporary Art Portfolio III

Yieldstreet's Athena Art Finance offers investors a series of portfolios consisting of art-secured loans originated by Athena.[81] The 2020 'Post-War and Contemporary Art Portfolio III' held an art-backed loan secured by 18 works with an aggregate value of $62.7 million. The collateral art included a piece by Jean-Michel Basquiat and was well-diversified with no one artwork accounting for more than 15% of the loan.[82] This fund had an investment horizon of 12 months and an attractive targeted 10% annualized interest.[83] Athena accepted investments between $10,000 and $500,000.[84] To lessen default risk, Athena partnered with a major auction house

[79] Artemundi Global Fund, "Financials."
[80] Artemundi Global Fund, "Financials."
[81] "Post War & Contemporary Art Portfolio III," Athena Art Finance Corp., YieldStreet, accessed August 16, 2022, https://www.yieldstreet.com/offering/MQ3sKw/post-war-contemporary-art-portfolio-iii/.
[82] Yieldstreet, "Post War & Contemporary Art Portfolio III."
[83] Yieldstreet, "Post War & Contemporary Art Portfolio III."
[84] Yieldstreet, "Post War & Contemporary Art Portfolio III."

(undisclosed) to perform conservative valuations for the loan.[85] Additionally, Athena utilized a loan-to-value ratio of 56.9% and required the borrower to maintain a personal net worth greater than the size of the loan until its maturity.[86]

The Post-War and Contemporary Art Portfolio III achieved a gross yield of 11% and charged a one percent management fee, ultimately meeting its target.[87] The success of this fund to raise capital was not only a result of its strong annualized target return but also a reflection of the borrower's creditworthiness – a HNWI with net assets of $200 million.[88] Furthermore, investors of the 'Post-War and Contemporary Art Portfolio III' fund were relying on the repayment of a low-risk loan rather than the strategical investment and eventual appreciation of art-related assets.

e. Fine Art Fund

The Fine Art Group was founded in 2001 by ex-Christie's employee Phillip Hoffman.[89] Shortly after, Hoffman and Lord Gowrie (also ex-Christie's) established the Fine Art Fund with an investment target of $350 million.[90] According to Horowitz, it took until 2013 for the fund to raise $300 million.[91] Since, the Fine Art Fund has not publicly disclosed funds under management but claims to have achieved an average annualized return of 18% on realized investments, with 92% of investments realized.[92] Similar to Artemundi, the Fine Art Group is not a pureplay fund and offers services in advisory, art finance, appraisal, and sales.[93] Therefore, the

[85] Yieldstreet, "Post War & Contemporary Art Portfolio III."
[86] Yieldstreet, "Post War & Contemporary Art Portfolio III."
[87] Yieldstreet, "Post War & Contemporary Art Portfolio III."
[88] Yieldstreet, "Post War & Contemporary Art Portfolio III."
[89] "Philip Hoffman," Team, The Fine Art Group, accessed December 6, 2022, https://www.fineartgroup.com/team/philip-hoffman/.
[90] Horowitz, *Art of the Deal*, 144.
[91] Horowitz, *Art of the Deal*, 221.
[92] The Fine Art Group, "Philip Hoffman."
[93] "Sales Agency," Our Services, The Fine Art Group, accessed December 6, 2022, https://www.fineartgroup.com/services/agency/.

Fine Art Group's level of market expertise and insider knowledge allows for strongly informed investment decisions, and an increased ability to overcome the art market's information asymmetry. Additionally, the Fine Art Group's broad range of services cheapens the friction costs associated with the fund's art investment. For example, the fund's management can utilize the Fine Art Group's sales services when liquidating at the end of the fund's life.

1.2.3 Summary of performance

As demonstrated by Chase Art Fund and Fernwood, art investment funds are unable to raise capital without convincing potential investors of the fund's ability to overcome the art market's illiquidity, opacity, and information asymmetry. This issue was also faced by the Art Trading Fund, Meridian Art Partners, and Dean Art Investments (as well as many others).[94] As Artemundi and the Fine Art Group are not just pureplay funds – but instead, long-standing art services companies – the fund's success is largely a result of market expertise, insider information, and contacts. The success of Yieldstreet's portfolios consisting of art-secured loans is related to the fund's structure and the creditworthiness of the borrower.

[94] Marion Maneker, "Art Funds: Who's Left Standing?," *Art Market Monitor*, April 9, 2009, https://www.artmarketmonitor.com/2009/04/09/art-funds-whos-left-standing/.

2 Characteristics of the art as an investment

2.1 Market efficiency

Coslor best captures academic consensus on art as an asset, concluding fine art has not developed into a legitimate financial investment category due to the market's low level of efficiency.[95] Economist William Sharp's Efficient Market Hypothesis states an asset's price will accurately reflect the asset's true value in an efficiently working market.[96] Therefore, the asset's price will mirror all known and existing information pertaining to that asset, enabling an uninformed investor to achieve a rate of return similar to an experienced investor.[97] Coslor argues the art market's inefficiency is caused by information asymmetry, market opacity, a narrow and seasonal market with low liquidity, and high transaction costs.[98] This is supported by Frey and Eichenberger who assert "many art markets are characterized by particularly high transaction costs, are seriously incomplete and often very thin (there are few Michelangelos traded per year)."[99] Albeit, a small number of investors and funds believe they can profit from the market's inefficiencies. For example, Yieldstreet's Athena Art Finance claim the fund's investment team "seeks to capitalize on market inefficiencies due to mispricing across the auction and dealer markets in order to acquire artworks at or below their appraised value."[100] Few have succeeded in this endeavor.

This section will outline the qualities of the art market resulting in its inefficiencies.

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[95] Coslor, "Wall Streeting Art," 10-46.
[96] Burton Malkiel, "The Efficient Market Hypothesis and Its Critics" (Working paper, Princeton University, 2003), 3.
[97] Malkiel, "The Efficient Market Hypothesis and Its Critics," 3.
[98] Coslor, "Wall Streeting Art," 10-46.
[99] Frey and Eichenberger, "On the Return of Art Investment Return Analyses," 207.
[100] "Art Equity Fund III," Athena Art Finance Corp, Yieldstreet, accessed August 2, 2022, https://www.yieldstreet.com/offering/LZ-YwA/art-equity-fund-iii/.

2.1.1 Market transparency

The art market is divided into two submarkets – the primary and secondary art market. The initial sale of an original work by dealers and gallerists occurs in the primary market, whilst the secondary market involves subsequent sales which are typically conducted at auction. Secondary market transactions are commonly disclosed at auction, allowing third parties access to pricing information. However, sale information in the primary market is not publicly available. As approximately 60% of sales occur in the primary market, the artworld is characterized by considerable information asymmetry – an issue arising from one party in a transaction being more informed than the other.[101] Individuals considering art investment for financial purposes – such as those investing in art funds – have little intrinsic desire for the artwork itself. Instead, art fund investors care only about the future value of the artwork. Therefore, when it comes to art fund investment, information is paramount. If potential investors believe fund managers lack the experience and knowledge required to overcome the art market's information asymmetry, the fund will fail to raise capital, as seen in the case of Fernwood.

Moreover, art is a heterogeneous good and traded infrequently, preventing investors from accurately estimating its FMV using comparables or historical data. Consider the Macklowe Collection sale of 2021, where Mark Rothko's *No. 7* (1951) appeared at auction for the first time since its creation.[102] Given *No. 7* is a unique asset, a recent and comparable sale could not be used to precisely estimate the FMV of this work. Consequently, Sotheby's appraisers listed *No. 7* with an auction estimate

[101] Clare McAndrew, *The Art Market 2022*, (New York: Art Basel and UBS, 2022), 68, https://d2u3kfwd92fzu7.cloudfront.net/Art%20Market%202022.pdf.
[102] "Lot 10," The Macklowe Collection, Sotheby's, accessed August 22, 2022, https://www.sothebys.com/en/buy/auction/2021/the-macklowe-collection/no-7?locale=en.

of $70 million to $90 million.[103] Uncertainty of this magnitude highlights the market's information asymmetry and presents a challenge for art funds when forecasting the asset's value during acquisition and exit.

2.1.2 Market liquidity and seasonality

Market liquidity refers to the efficiency at which an asset can be converted to cash without impacting its market price.[104] Transactions in a given stock market occur frequently allowing an investor to sell shares with relative ease. The art market, on the other hand, is characterized by low liquidity and low trading volume, highlighted by Baumol who asserts "the resale of a given art object may not even occur once in a century."[105]

One reason for the inefficiency of art sales is its small market size. As art is a luxury good, a small portion of the global population participates in the market. This is demonstrated by a comparison of the global equity market size in 2021, $108 trillion, with the global art market size of $65.1 billion.[106]

Secondly, the art market is highly illiquid due to the lengthy and complicated art-selling process. To sell an artwork, investors are typically required to engage an auction house which requires several appointments with specialists to determine the artwork's suitability for auction, arrange for the artwork's transport, and execute its cataloging and marketing. The auction sales process takes approximately three to six months.[107]

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[103] *No. 7* sold for $82,468,500;
Sotheby's, "Lot 10."
[104] "Liquidity," Business Development Bank of Canada, accessed December 6, 2022, https://www.bdc.ca/en/articles-tools/entrepreneur-toolkit/templates-business-guides/glossary/liquidity.
[105] Baumol, "Unnatural Value," 11.
[106] "Research Quarterly: Equities," Securities Industry and Financial Markets Association, accessed August 23, 2022, https://www.sifma.org/resources/research/research-quarterly-equities/;
Brian Boucher, "Seven key takeaways from the 2022 Art Market Report," Art Basel, accessed August 23, 2022, https://www.artbasel.com/stories/seven-key-takeaways-from-the-2022-art-market-report.
[107] Frey and Eichenberger, "On the Return of Art Investment Return Analyses," 213.

Thirdly, the aesthetic or sentimental value of art acts as a constraint for the art market's liquidity. Owners typically hold artworks for long periods to enjoy in their homes or pass on to family members, and most art investors employ a buy-and-hold strategy for the sake of increasing the artwork's value. Additionally, the majority of tradeable art is often held in museums or private collections until either "death, debt, divorce or dissolution."[108]

Finally, unlike the daily transactions taking place in the financial markets, art auctions are seasonal. For example, in New York, most contemporary art sales occur between May and November, and in London between October and June.[109] Coslor concurs, asserting "this seasonal effect is one reason why artworks are considered to be illiquid, or difficult to sell quickly."[110]

The lack of ready buyers and depth of the market can result in losses for investors looking to sell art quickly. Consequently, art as a financial asset can carry high risk, as the bid-ask spread can be significant. This is particularly true when the ratio of buyers to sellers is unbalanced, as sellers may not find a buyer or sell at the desired price. As noted by art economy author Jeremy Eckstein, "you don't wake up one morning, look at the FTSE, phone your broker and say 'get out of industrials and into impressionists'...if you are buying shares, you can sell them and know what price you're going to get. You can't do that with art."[111]

2.1.3 Friction costs

Friction costs, (i.e., total direct and indirect costs associated with a financial transaction) are a significant drawback for art investors. When purchasing art, investors are charged a buyer's commission ranging from 30-50% when acquiring

[108] Day, Favato, and Mamarbachi, "Art as an Alternative Investment Asset," 7.
[109] Coslor, "Wall Streeting Art," 84.
[110] Coslor, "Wall Streeting Art," 84.
[111] Jeremy Eckstein, "Treating Art as an Asset Class," Jeremy Eckstein and Associates, 2006.

from a gallerist or dealer, or approximately 25% from an auction house.[112] This is far greater than the commission paid to a stockbroker, which is typically between one and two percent. Additional costs may include insurance, transportation, and storage. For selling an artwork, costs can include the aforementioned bid-ask spread, seller's commission, transportation, and value-added taxes. Additionally, these costs are typically hidden and therefore unpredictable, adding to the issue of information asymmetry and the market's inefficiency.[113] Transaction costs also vary considerably between countries, individuals, gallerists, dealers, and auction houses. [114] For art funds, transaction costs within the art market are passed on to the investor through management fees, lowering the investor's gross returns.

2.2 Market characteristics

This section addresses additional idiosyncrasies and characteristics of the art market impacting the viability of art as an investment.

2.2.1 Determinants of price

Due to the art market's opacity, heterogeneity, and limited information, a single deterministic pricing structure does not exist.[115] This intensifies the issue of information asymmetry and market inefficiencies, as investors are unable to accurately determine an artwork's true value. Conversely, investors of conventional assets – such as stocks – can (in principle) determine the price of a stock by calculating the discounted present value of the company's expected future earnings.[116]

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[112] Jason Horejs, "Ask a Gallery Owner | Why Do Galleries Get Such High Commissions?," *RedDotBlog*, October 3, 2022, https://reddotblog.com/ask-a-gallery-owner-why-do-galleries-get-such-high-commissions-21/;
"Buyer's premium: is art becoming increasingly expensive?," *artprice*, March 9, 2021, https://www.artprice.com/artmarketinsight/buyers-premium-is-art-becoming-increasingly-expensive.
[113] Day, Favato, and Mamarbachi, "Art as an Alternative Investment Asset," 8.
[114] Frey and Eichenberger, "On the Return of Art Investment Return Analyses," 211.
[115] Juan Prieto-Rodriguez 1
[116] Baumol, "Unnatural Value," 11.

However, there is a range of factors that can be used to estimate an artwork's price. Academics Marc Day, Giampiero Favato, and Raya Mamarbachi believe these factors can be divided into four groups: the artist, the work of art, the market, and the macroeconomic environment.[117] Factors relating to the artist include reputation and fame, whilst artwork-related determinants of price include the work's condition, subject, technique, scale, and authenticity.[118] Market-based factors may include preferences, trends, the time of the year (i.e., whether or not the work is sold in its respective auction season), and the selected auction house. Macroeconomic factors include the state of financial markets or inflation. Historically, stock markets in a bull market phase have temporarily stimulated the art market, therefore increasing the price of paintings.[119]

Additionally, it's important to consider changes in taste when estimating an artwork's price. For example, academics Filip Vermeylen, Maarten van Dijck, and Veerle de Laet observe high volatility in market preferences over time for Flemish and Dutch painters, claiming many artists considered on-trend at different periods "fell through the cracks of history".[120] Another example of changes in taste is subject related to hunting and dead game, which is less popular today as it was in the 19th century – now considered by many as politically incorrect.[121] The corresponding market for this subject has therefore diminished.

[117] Day, Favato, and Mamarbachi, "Art as an Alternative Investment Asset," 4.
[118] Day, Favato, and Mamarbachi, "Art as an Alternative Investment Asset," 4.
[119] William Goetzmann, "Accounting for Taste: Art and the Financial Markets Over Three Centuries," *The American Economic Review* 83, no. 5 (1993): 1375.
[120] Fabian Bocart, Eric Ghysels, and Christian Hafner, "Monthly Art Market Returns," *Journal of Risk and Financial Management* 13, no. 100 (2020): 12;
Filip Vermeylen, Maarten van Dijck, and Veerle de Laet, "The test of time. Art encyclopedia and the formation of the canon of seventeenth-century painters in the low countries," *Empirical Studies of the Arts* 31, no. 1 (2013): 81-105.
[121] Frey and Eichenberger, "On the Return of Art Investment Return Analyses," 215.

Finance academics Luc Renneboog and Christophe Spaenjers' study on art market returns analyzes the approximate impact of various artwork characteristics on its price (outlined below in Table 2), and conclude artist reputation, attribution, signs of authenticity, medium, size, topic, and the timing and location of the sale are strongly correlated with the artwork's price.[122] The study reveals that works are on average priced 13.5% higher if the artist is mentioned in an "important art history reference book."[123] Unsurprisingly, attribution characteristics have a substantial negative impact on an artwork's price, whilst authenticity characteristics, such as a painting being signed, can have a positive impact. The most expensive auctions are in May and June (Spring) and November and December (Fall). Moreover, the highest prices for artworks sold at auction occur at Sotheby's and Christie's. It is important to note this study has an R^2 value of 0.64, meaning 64% of the variation in the dependent variable (price impact) is predictable from the independent variable (artwork characteristic).

Table 2: Renneboog and Spaenjers, the price impact of art characteristics (2007)

Variable	**Price Impact (%)**
Artist characteristics	
Inclusion in textbook*	13.46
Attribution characteristics	
Attributed	-52.12
Studio	-54.96
Circle	-64.97
School	-75.71
After	-84.82
Style	-79.17
Authenticity characteristics	
Signed	31.04
Dated	18.60
Topic	
Study	-18.53

[122] Luc Renneboog and Christophe Spaenjers, "Buying Beauty: On Prices and Returns in the Art Market," *Management Science* 59, no. 1 (2013): 2.
[123] Renneboog and Spaenjers, "Buying Beauty," 9.

Abstract	-7.50
Animals	-15.66
Landscape	-12.37
Nude	-15.17
People	-3.65
Portrait	-20.37
Religion	-10.54
Self-portrait	12.77
Still life	4.18
Month of sale	
January	[left out]
February	-11.39
March	3.23
April	8.97
May	14.16
June	15.37
July	8.80
August	-6.09
September	-14.78
October	0.07
November	19.98
December	16.38
Auction house	
Sotheby's London	88.22
Sotheby's New York	105.35
Sotheby's Other	36.44
Christie's London	90.94
Christie's New York	95.12
Christie's Other	16.65
Bonhams London	12.52
Bonhams Other	-11.24
Phillips London	24.23
Phillips Other	12.35
R^2	**0.6411**

Note: TEXTBOOK means the artist was included in the last edition of "Gardner's Art Through the Ages" (1926, 1959, 1980, 1996, or 2004) prior to the artwork's sale.
Source: data from Luc Renneboog and Christophe Spaenjers, "Buying Beauty: On Prices and Returns in the Art Market," *Management Science* 59, no. 1 (2013): 25-26, table 2.

2.2.2 Risk-return profile

a. Returns

Equity and bonds are homogeneous goods traded daily, whilst fine art is a heterogeneous good infrequently traded. Accordingly, it can be illogical to draw inferences on returns between different artworks and markets.[124] Baumol concurs, "the art market simply does not provide the continuous data or even the continuous transactions that would be required for a systematic analysis of sophisticated issues."[125]

Most studies attempt to bypass heterogeneity issues by using a 'repeat sales regression' (RSR) analysis method or homogenizing data as much as possible using the 'hedonic regression' (HR) technique. RSR only observes objects that trade twice or more. HR identifies hedonistic factors that may affect the price of the artwork – such as those recognized in Renneboog and Spaenjers' study – and subtracts the implicit price of these characteristics from the artwork's total price.[126] The main disadvantage of RSR is that it discards the many artworks that have only been sold once during the observed period.[127] Given only artworks traded twice are analyzed (i.e., artworks that likely have greater demand), selection bias applies when calculating returns which potentially inflates results. HR is prone to model specification error, as measures of explanatory characteristics may not be high-quality.[128] Consensus on the superior regression method is disputed among academics.

[124] Nathalie Buelens and Victor Ginsburgh, "Revisiting Baumol's 'art as a floating crap game'," *European Economic Review* 37, no. 1 (1993): 1352.
[125] Baumol, "Unnatural Value," 12.
[126] Buelens and Ginsburgh, "Revisiting Baumol's 'art as a floating crap game'," 1356.
[127] Bruno Frey and Reto Cueni, "Why Invest in Art?" *The Economists' Voice* 10, no.1 (2013): 2.
[128] Bocart, Ghysels, and Hafner, "Monthly Art Market Returns," 2.

Due to the heterogeneous nature of fine art and the varying methods used to calculate the art market's returns, results of real returns on paintings across recognized academic studies of the art market are inconsistent.

Table 3: Results from academic studies on the real rate of return of paintings

Time period	**Author**	**Analysis**	**No. of transactions studied**	**Annualized average rate of return (%)**
1652-1961	Baumol	RSR Gross returns	640	0.55
1635-1987	Frey, Pommerehne	RSR Net of buyer's and seller's commission, and sales taxes	1,198	1.5
1716-1986	Goetzmann	RSR Gross returns	3,329	3.2
1700-1961	Buelens, Ginsburgh	RSR Gross returns	1,834	0.65
1976-2001	Worthington, Higgs	RSR Geometric mean Gross returns	94,514	2.54
1982-2007	Renneboog, Spaenjers	HR Gross returns	1,088,709 (for entire 1957-2007 data set)	5.19
2003-2017	Bocart, Ghysels, Hafner	RSR Net of buyer's commission	2,809	4.0

Sources: data from Andrew Worthington and Helen Higgs, "Art as an investment: risk, return and portfolio diversification in major painting markets," *Accounting and Finance* 44, no. 1 (2004): 262, table 1; Bruno Frey and Werner Pommerehne, "Art Investment: An Empirical Inquiry," *Southern Economic Journal* 56, no. 2 (1989): 398, table I; Fabian Bocart, Eric Ghysels, and Christian Hafner, "Monthly Art Market Returns," *Journal of Risk and Financial Management* 13, no. 100 (2020): 9, table 1; Luc Renneboog and Christophe Spaenjers, "Buying Beauty: On Prices and Returns in the Art Market," *Management Science* 59, no. 1 (2013): 29, table 5; Nathalie Buelens and Victor Ginsburgh, "Revisiting Baumol's 'art as a floating crap game'," *European Economic Review* 37, no. 1 (1993): 1356, table 4; William J. Baumol, "Unnatural Value: Or Art Investment as Floating Crap Game," *American Economic Review* 76, no. 2 (May 1986): 13; William Goetzmann, "Accounting for Taste: Art and the Financial Markets Over Three Centuries," *The American Economic Review* 83, no. 5 (1993): 1374, table 2.

Despite varying results, all studies demonstrate a low probability of successful strategic investment in the art market. Marginally larger returns are found in more recent studies – possibly a result of rising levels of global wealth and a considerable increase in art's value (particularly contemporary art) from the late 60s onwards. This is supported by Renneboog and Spaenjers, who find the performance of art as an asset is dependent on wealthy households' demand for luxury consumption, and that art prices are affected by changes in equity wealth.[129]

There are several limitations and challenges involved in analyzing art returns, aggravating the market's issue of opacity. Most existing studies are restricted to auction data which accounts for approximately half the artworld's transactions.[130] Further, transaction costs and taxes are disregarded in most studies. For studies omitting transaction costs, Renneboog and Spaenjers warn returns estimates should be "considered an upper bound on the rate of return."[131] Additionally, studies on sales before 1920 are mostly limited to sales at Sotheby's and Christie's in London, as the auction houses had not yet expanded globally.[132] Therefore, much of the world's secondary market data is excluded in the studies of Baumol, Frey and Pommerehne, Goetzmann, and Buelens and Ginsburgh.[133] It can also be assumed the low rate of returns found in all studies is affected by selection bias, as only successful art is repeatedly auctioned.[134]

b. Risk

A market's risk is measured by standard deviation. Standard deviation calculates the dispersion of an asset's price relative to the mean price in a dataset. The higher the

[129] Renneboog and Spaenjers, "Buying Beauty," 4.
[130] Frey and Eichenberger, "On the Return of Art Investment Return Analyses," 207.
[131] Renneboog and Spaenjers, "Buying Beauty," 7.
[132] Frey and Pommerehne, "Art Investment: An Empirical Inquiry," 396–397.
[133] Frey and Pommerehne, "Art Investment: An Empirical Inquiry," 396–397.
[134] Frey and Pommerehne, "Art Investment: An Empirical Inquiry," 406.

standard deviation, the more dispersed the asset's prices within the dataset, the greater the asset's volatility, and the greater the asset's risk.

However, it's important to note limitations exist when analyzing historical volatility in an illiquid market with infrequent transactions. Market liquidity refers to the depth of buy and sell orders, and volatility refers to a market's rate of change. A more liquid market means an investor can trade faster, and a volatile market is one where prices fluctuate rapidly over time. The more liquid a market is, the more accurate the technical analysis of its volatility is. In an illiquid market, the effective quotations of the bid-ask spread prices for which an investor is willing to trade will disappear and cannot be observed until the asset is traded again.[135] In the case of the art market, this can be decades. Therefore, it is highly likely standard deviation does not accurately measure the market's level of risk.

Table 4 outlines the volatility of the art market according to the aforementioned studies. Results vary substantially, likely due to the limitations related to studying an illiquid market's standard deviation. However, all authors of the below studies mention art is a high-risk asset.

Table 4: Results from academic studies on the volatility of painting prices

Time period	**Author**	**Analysis**	**No. of transactions studied**	**Stdev. (%)**
1635-1987	Frey, Pommerehne	RSR Gross returns	1,198	5
1716-1986	Goetzmann	RSR Net of buyer's and seller's commission, and sales taxes	3,329	56.5
1700-1961	Buelens, Ginsburgh	RSR and price indices Gross returns	1,834	10.8

[135] When volatility is low, bid-ask spreads are narrow. When volatility is high, bid-ask spreads are wide;
Jun Muranaga and Makoto Ohsawa, *Measurement of Liquidity Risk in the Context of Market Risk Calculation* (Japan: Bank of Japan, 1997), 195.

1976-2001	Worthington, Higgs	RSR Gross returns	94,514	10.12
1982-2007	Renneboog, Spaenjers	RSR Geometric mean Gross returns	1,088,709 (for entire 1957-2007 data set)	18.04
2003-2017	Bocart, Ghysels, Hafner	HR Gross returns	2,809	10

Note: 'Stdev' is an abbreviation of standard deviation.
Sources: data from Andrew Worthington and Helen Higgs, "Art as an investment: risk, return and portfolio diversification in major painting markets," *Accounting and Finance* 44, no. 1 (2004): 265, table 2; Bruno Frey and Werner Pommerehne, "Art Investment: An Empirical Inquiry," *Southern Economic Journal* 56, no. 2 (1989): 398, table I; Fabian Bocart, Eric Ghysels, and Christian Hafner, "Monthly Art Market Returns," *Journal of Risk and Financial Management* 13, no. 100 (2020): 9, table 1; Luc Renneboog and Christophe Spaenjers, "Buying Beauty: On Prices and Returns in the Art Market," *Management Science* 59, no. 1 (2013): 29, table 5; Nathalie Buelens and Victor Ginsburgh, "Revisiting Baumol's 'art as a floating crap game'," *European Economic Review* 37, no. 1 (1993): 1356, table 4; William Goetzmann, "Accounting for Taste: Art and the Financial Markets Over Three Centuries," *The American Economic Review* 83, no. 5 (1993): 1374, table 2.

c. Comparison with conventional assets

Table 5 below compares the risk and return characteristics of paintings with conventional assets. In all studies, art is outperformed by conventional assets, except in Renneboog and Spaenjers' study in which art is found to realize greater returns than T-bills, gold, and commodities. However, volatility is found to be greatest among all markets only in Renneboog and Spaenjers' study. By contrast, academics Andrew Worthington and Helen Higgs, and Fabian Bocart, Eric Ghysels, and Christian Hafner find art is the least volatile market other than T-bills. The Sharpe Ratio is also included – a mathematical expression measuring the excess return an investor receives for holding a riskier asset, by comparing the riskier asset's return to a risk-free asset's returns.[136] The studies below find varying results for Sharpe ratios, however, both calculate lower Sharpe ratios for art relative to S&P500 stocks.

[136] "Refining the Sharpe Ratio (Digest Summary)," CFA Institute, accessed December 6, 2022, https://www.cfainstitute.org/en/research/cfa-digest/2010/02/refining-the-sharpe-ratio-digest-summary#:~:text=The%20Sharpe%20ratio%20is%20a,%2Dmonth%20T%2Dbill%20rate.

Table 5: Risk-return characteristics of paintings versus traditional assets

Author	Date	Investment	Annualized returns (%)	Stdev. (%)	Sharpe ratio (%)
Worthington, Higgs	1976-2001	Art	2.54	10.12	--
		U.S. large company stocks	13.19	13.21	--
		U.S. small company stocks	16.82	15.29	--
		U.S. long-term corporate bonds	9.15	10.51	--
		U.S. long-term government bonds	9.16	11.68	--
		Treasury bills	6.49	2.62	--
Renneboog, Spaenjers	1982-2007	Art	5.19	18.04	27.25
		T-bills	1.99	1.88	N.A
		U.S. government bonds	5.77	9.87	45.03
		Global government bonds	5.98	7.53	57.17
		S&P500 stocks	9.33	15.34	57.07
		Global stocks	8.91	16.76	50.39
		Gold	-0.89	14.80	-11.71
		Commodities	2.06	10.28	05.11
		U.S. real estate	2.41	4.73	9.02
Bocart, Ghysels, Hafner	2003-2017	Global art index	4.00	10.00	37.0
		S&P500 stocks	8.00	14.00	56.0
		Gold	10.00	18.00	53.0
		Real estate ETF	10.00	23.00	43.0

Note: 'Stdev' is an abbreviation of standard deviation.
Sources: data from Andrew Worthington and Helen Higgs, "Art as an investment: risk, return and portfolio diversification in major painting markets," *Accounting and Finance* 44, no. 1 (2004): 265, table 2; Fabian Bocart, Eric Ghysels, and Christian Hafner, "Monthly Art Market Returns," *Journal of Risk and Financial Management* 13, no. 100 (2020): 9, table 1; Luc Renneboog and Christophe Spaenjers, "Buying Beauty: On Prices and Returns in the Art Market," *Management Science* 59, no. 1 (2013): 29, table 5.

Financial assets typically generate monetary returns, whilst art investment yields both monetary and positive psychological returns from the enjoyment and social esteem of art ownership. This may partly explain art's smaller monetary returns

relative to conventional assets, as no psychic return exists in financial markets.[137] Here lies another issue for art investment funds – if investors in art funds cannot access the phycological benefits of art ownership, then they solely rely on the monetary returns of art. This increases the need for highly knowledgeable art-market professionals in an art fund to outperform conventional markets. However, art funds can create additional returns by leasing out the fund's collection. This can help fund managers offset the market's uncertainty, and add value to the collection's provenance.

d. Diversification

Like many proponents of art investment, art market consultant Spencer Ewen believes art is an appealing asset due to its "comparatively low correlation" with other securities.[138] Correlation is a statistical measurement that describes the extent to which two variables move in coordination with each other.[139] In the context of investment returns, zero correlation indicates the two asset's returns are not related. A negative correlation means the asset's returns move in opposite directions. According to Markowitz's MPT, building a diversified portfolio of investments with low or negative correlation allows investors to maximize returns, whilst minimizing exposure to individual asset risk. Therefore, if the art market has a low or negative correlation with other asset markets, in theory, it should be beneficial for portfolio diversification. Studies mentioned in this chapter – such as Bocart, Ghysels, and Hafners', and Renneboog and Spaenjers'— have found the art market has no more than a moderate correlation with any compared asset. Renneboog and Spaenjers' findings are highlighted in Table 6 below.

[137] Frey and Cueni, "Why Invest in Art?" 5.
[138] Day, Favato, and Mamarbachi, "Art as an Alternative Investment Asset," 6.
[139] "Correlation," Corporate Finance Institute, accessed December 6, 2022, https://corporatefinanceinstitute.com/resources/data-science/correlation/.

Table 6: Renneboog and Spaenjers, correlation of art's returns with traditional assets (1957-2007)

Asset	Art	T-bills	U.S. government	Global government	S&P 500 stocks	Global stocks	Gold	Commodities	U.S. real estate
Art	1	0.01	-0.2	-0.1	-0.3	0.2	0.3	0.44	0.39
T-bills		1	0.56	0.46	0.34	0.28	-0.54	-0.41	-0.24
U.S. government bonds			1	0.88	0.27	0.18	-0.18	-0.26	-0.13
Global government bonds				1	0.33	0.33	-0.13	-0.25	-0.07
S&P 500 stocks					1	0.88	-0.28	-0.15	-0.15
Global stocks						1	-0.15	-0.07	0.02
Gold							1	0.55	0.24
Commodities								1	0.16
U.S. real estate									1

Source: data from Luc Renneboog and Christophe Spaenjers, "Buying Beauty: On Prices and Returns in the Art Market," *Management Science* 59, no. 1 (2013): 27, table 5.

An efficient frontier is analyzed to determine whether the art market's low level of correlation with conventional assets makes it a suitable tool for multi-asset portfolio diversification. The efficient frontier is part of MPT and is used to graphically represent the set of optimal portfolios that offer the highest expected return given a defined level of risk.[140] The efficient frontier is a curve representing all possible portfolios that can be constructed using a set of assets (as seen below in Figure 5). Despite all portfolios consisting of the same assets, the portfolios are not the same because the weighting of each asset in every portfolio is different.[141] The efficient

[140] "Efficient Frontier," Corporate Finance Institute, accessed December 6, 2022, https://corporatefinanceinstitute.com/resources/wealth-management/efficient-frontier/.
[141] "Efficient Fronter," Option Alpha, accessed December 6, 2022, https://optionalpha.com/learn/efficient-frontier.

frontier is based on the notion that diversification of assets in a portfolio can reduce portfolio risk without sacrificing returns.[142] Therefore, by investing in asset combinations along the curve, an investor can keep risk at a minimum whilst maximizing returns.[143] Portfolios to the right of the efficient frontier are inferior to the portfolios on the efficient frontier, as they offer the same return for higher risk or the same risk for lower returns.[144] In theory, portfolios plotted farthest from the efficient frontier should be excluded from the set of efficient portfolios.[145]

Figure 5: Worthington and Higgs' multi-asset efficient frontier

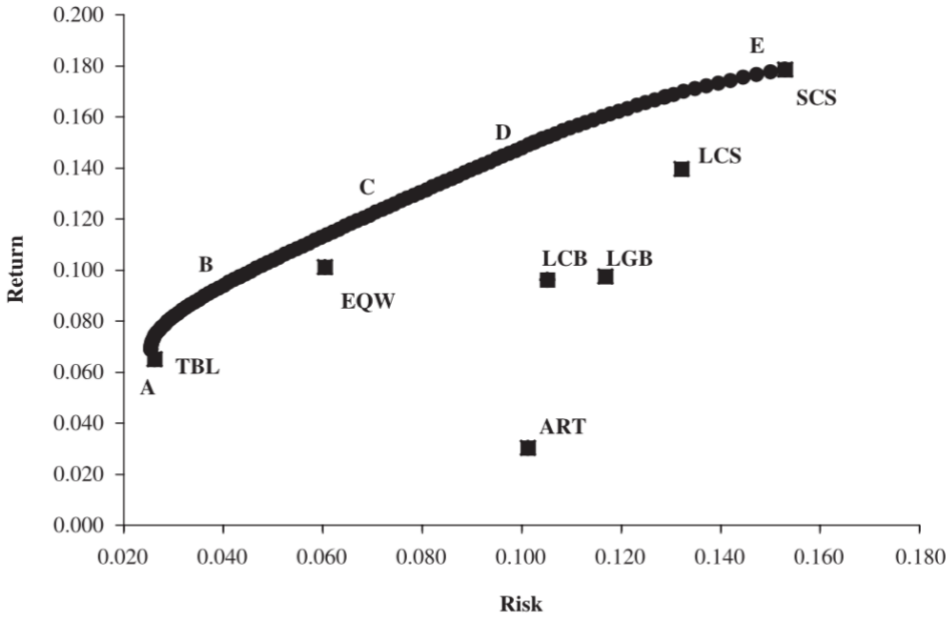


Figure 2 Efficient frontier for art and financial investments. *ART* = art market, *LCS* = large company stocks, *SCS* = small company stocks, *LCB* = long-term corporate bonds, *LGB* = long-term government bonds, *TBL* = Treasury bills, *EQW* = equally weighted portfolio.

Worthington and Higgs create an efficient frontier composed of indices for nine categories of paintings and five financial markets.[146] The categories of paintings

[142] Corporate Finance Institute, "Efficient Frontier."
[143] Option Alpha, "Efficient Frontier."
[144] Corporate Finance Institute, "Efficient Frontier."
[145] Worthington and Higgs, "Art as an investment," 267.
[146] Andrew Worthington and Helen Higgs, "Art as an investment: risk, return and portfolio diversification in major painting markets," *Accounting and Finance* 44, no. 1 (2004): 260.

include Contemporary Masters (CM), French Impressionists (FI), Modern European (ME), 19th Century European (NE), Old Masters (OM), Surrealists (SR), 20th Century English (TE), and Modern U.S. Paintings, (US). The financial market indices constructed for this analysis include small company stocks (*SCS*), large company stocks (*LCS*), long-term corporate bonds (*LCB*), long-term government bonds (*LGB*), and treasury bills (*TBL*).[147] Also included in the efficient frontier is a general art asset class (ART), and an equally weighted portfolio (EQW).[148] The efficient frontier's returns fall between 6.9% at the minimum variance point and 17.9% at its uppermost, whilst its level of risk ranges from 2.5% to 15.3%[149] However, the art market is not included in any risk-return optimal portfolios on the efficient frontier.[150]

Despite the art market exhibiting low or negative correlation with conventional assets in Renneboog and Spaenjers' study, Worthington and Higgs find the risk-return profile of art as an asset is far less attractive than that of equity and debt markets in the efficient set. It can be assumed that there are no diversification benefits of art investment in a multi-asset portfolio.[151] Worthington and Higgs state "at first impression, the low correlations of returns … between art works and financial assets are suggestive of the benefits of portfolio diversification… however, it is also the case that the risk-return attributes of art are so inferior to financial assets … that inclusion of these assets for diversification purposes in financial asset portfolios cannot be supported."[152]

[147] Worthington and Higgs, "Art as an investment," 261.
[148] Worthington and Higgs, "Art as an investment," 268.
[149] Worthington and Higgs, "Art as an investment," 268.
[150] Worthington and Higgs, "Art as an investment," 268.
[151] Worthington and Higgs, "Art as an investment," 269.
[152] Worthington and Higgs, "Art as an investment," 269.

Figure 6: Worthington and Higgs' art market efficient frontier

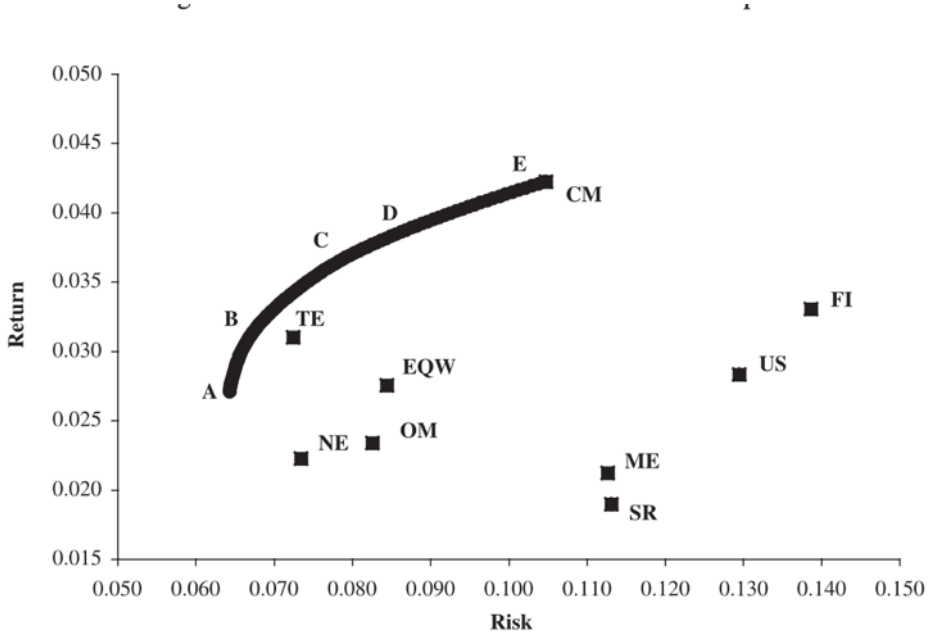


Figure 1 Efficient frontier for art investments. *CM* = Contemporary Masters, *FI* = French Impressionists, *ME* = Modern European, *NE* = 19th Century European, *OM* = Old Masters, *SR* = Surrealists, *TE* = 20th Century English, *US* = Modern US Paintings, *EQW* = equally weighted portfolio.

Worthington and Higgs also graph an efficient frontier composed only of the nine painting indices.[153] This efficient frontier is relevant to pureplay art investment funds that use diversification as a strategy, such as Artemundi's Global Art Fund. The returns for the efficient frontier vary from 2.7% to 4.2%.[154] This is considerably lower than returns on the efficient frontier for the multi-asset portfolio above. Further, only Contemporary Masters lies on the efficient frontier, whilst French Impressionists and Modern U.S. Paintings are excluded from the set of efficient portfolios, as these individual indices are farthest from the curve.[155] The Contemporary Masters index typically dominates portfolios on the curve with high-risk-return characteristics, and 20th Century English dominates low-risk-return portfolios.[156] Worthington and Higgs

[153] Worthington and Higgs, "Art as an investment," 260.
[154] Worthington and Higgs, "Art as an investment," 267.
[155] Worthington and Higgs, "Art as an investment," 267.
[156] Worthington and Higgs, "Art as an investment," 267.

find the efficient frontier is mostly comprised of only two or three of the asset classes at any point along the curve.[157] For example, when returns equal 2.7%, the portfolio is weighted accordingly: 21.1% 19th Century European, 27.5% Old Masters, and 51.4% 20th Century English.[158] Therefore, it can be assumed that any benefits to be gained from diversifying an art portfolio, can be achieved by investing in a small number of painting markets.[159]

e. Inflationary hedge

Due to the success of BRPF which effectively beat inflation using art, art collectors often justify art investment as an inflationary hedge.[160] Former Head of Art Banking and Numismatics at UBS, Dr. Karl Schweizer, asserts adequate hedging using art is achieved by investing over long periods.[161] This is supported by Frey and Pommerehne, who find a damaging effect of inflation on financial assets resulted in profitable investment in paintings.[162] However, Frey and Pommerehne argue a decline in inflation will make investments in conventional assets more attractive than paintings, as an opportunity loss of approximately 1.5% per year from art investment is re-established.[163]

2.2.3 Market regulation

The trading of art is highly unregulated, rife with insider information, and lacking reporting obligations. The art market has not developed a strong, regulated pricing mechanism, deterring potential investors due to information asymmetry. By contrast, many conventional assets – for example equities – are required to follow a systematic

[157] Worthington and Higgs, "Art as an investment," 267.
[158] Worthington and Higgs, "Art as an investment," 267.
[159] Worthington and Higgs, "Art as an investment," 268.
[160] Coslor, "Wall Streeting Art," 14.
[161] Day, Favato, and Mamarbachi, "Art as an Alternative Investment Asset," 6.
[162] Frey and Pommerehne, "Art Investment: An Empirical Inquiry," 406.
[163] Frey and Pommerehne, "Art Investment: An Empirical Inquiry," 406.

approach for asset valuation and financial reporting, such as the International Financial Reporting Standards.[164] Another risk associated with art investment is the inflating of art prices (and in turn the work's perceived FMV) through trading at auction. For example, the sale of David Hockney's *Portrait of an Artist (Pool with Two Figures)* (1972) in November of 2018 is speculated (although not confirmed) to have been bought by the consignor to maintain its high price.[165] As details regarding the artwork's purchaser are kept private, art investors are unable to assess if a work is being repurchased, and therefore its perceived value is manipulated. Collectors and art investors are also exposed to risks associated with authenticity – an issue absent in the trading of conventional securities. This is exemplified by the reputable Knoedler Gallery in 2016, which unknowingly purchased $80 million worth of forgeries, some of which claimed to be painted by Rothko, Pollock, and de Kooning.[166] Another risk associated with art investment is government intervention in the art market. For example, the government may implement regulation on export restrictions, or simply elect to seize art objects considered national heritage.[167]

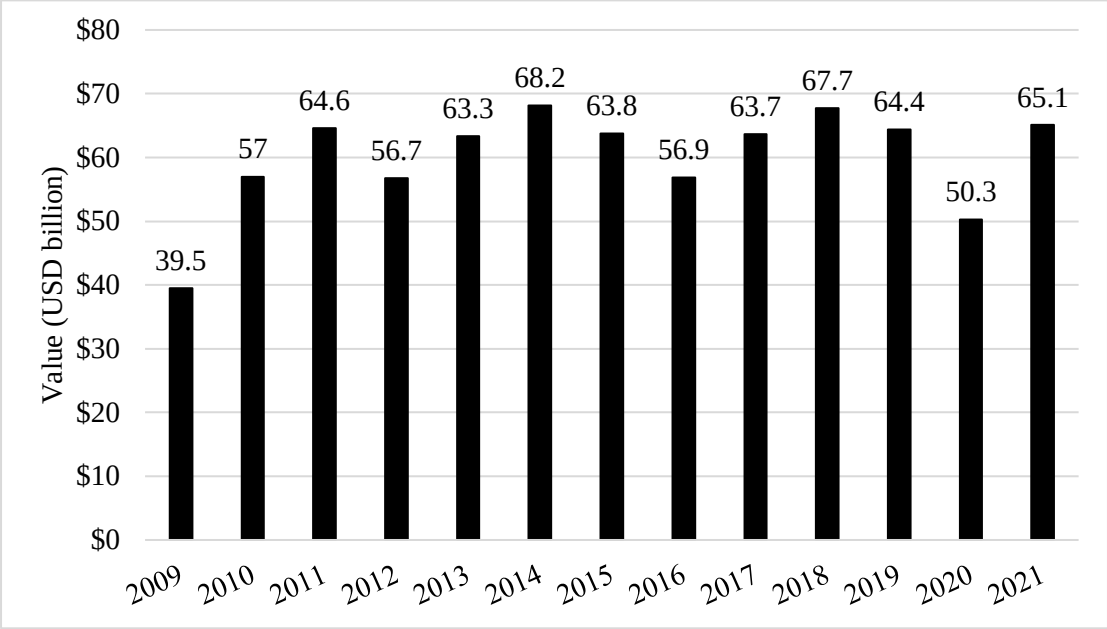
2.2.4 The Covid-19 pandemic

Like most markets during the Covid-19 pandemic, in 2020 the art market faced its biggest recession in 10 years with a decline in market size by 22%.[168] The art market is highly exposed to Covid-19, as restrictions on the art industry's operations and

[164] "IFRS: International Financial Reporting Standards," CFA Institute, accessed September 20, 2022, https://www.cfainstitute.org/en/advocacy/issues/international-finance-reporting-stds#sort=%40pubbrowsedate%20descending.
[165] Martin Gammon, "The Risks of Using Auction Prices as Artwork's Fair Market Value," Artsy.net, November 27, 2018, https://www.artsy.net/article/artsy-editorial-risks-auction-prices-artworks-fair-market-value.
[166] Yanan Wang, "A venerated Manhattan gallery on trial in lawsuit after 'genius' forgeries rake in $80 million," *The Washington Post*, January 26, 2016, https://www.washingtonpost.com/news/morning-mix/wp/2016/01/26/a-venerated-manhattan-gallery-goes-on-trial-for-fraud-after-a-chinese-immigrants-forgeries-rake-in-80-million/.
[167] Frey and Cueni, "Why Invest in Art?," 5.
[168] McAndrew, *The Art Market 2022*, 23.

events prevent sales, in addition to government-imposed restrictions on travel. [169] Furthermore, decreased spending by HNWI as a result of declining levels of wealth or loss of confidence in markets, directly impacted the art market.[170]

Figure 7: Sales in the global art market 2009-2021



Source: data from Clare McAndrew, *The Art Market 2022*, (New York: Art Basel and UBS, 2022), 25, figure 1.1, https://d2u3kfwd92fzu7.cloudfront.net/Art%20Market%202022.pdf.

However, the market's recovery in 2021 exceeded its decline with a growth rate of 29%, which resulted in a market size greater than pre-pandemic levels.[171] This outcome was related to increases in HNWI wealth as financial markets recovered.[172]

During the 2019-2020 period, the market moved online and the artworld's digitalization intensified.[173] For example, galleries began offering online viewing experiences through online viewing rooms (OVR). Technological advancements in the industry have increased the accessibility of the art market, as collectors and gallerists can now view and transact art without travel. Not only will this allow for

[169] McAndrew, *The Art Market 2022*, 23.
[170] McAndrew, *The Art Market 2022*, 23.
[171] McAndrew, *The Art Market 2022*, 25.
[172] McAndrew, *The Art Market 2022*, 25.
[173] McAndrew, *The Art Market 2022*, 25.

growth in the industry, digitalization of the artworld brings art as an investment closer to stocks and bonds, whose trades primarily occur online.

The artworld's digitalization may also increase the disclosure of sale prices within the primary market. Galleries and dealers are now using online platforms to list artworks available for purchase and are more frequently including the artwork's sale price. This increases transparency within the art market, and alleviates issues related to information asymmetry.

3 Overview of NFTs

In recent years, 'non-fungible tokens' (hereafter NFTs) – a unique asset that exists digitally – have exploded in popularity. Digital images of pixelated figures are selling for millions of dollars, and an endless supply of headlines regarding celebrity and major brand engagement with NFTs has permeated news feeds globally. Additionally, the profitability of several NFT projects has caught the attention of the world's largest auction houses. In 2022, an NFT market analysis was included for the first time in *The Art Basel and UBS Global Art Market Report*, signifying its importance to the artworld. Chapter 3 provides an overview and history of NFTs to underscore the reasons this technology is now widespread and addresses why and how it has penetrated the art market. Crucial to understanding the NFT market is an understanding of blockchain and cryptocurrencies, which are explained in the following sections.

3.1 Blockchain

Blockchain is a digitally distributed database, meaning it is shared and updated independently by each of the network's participants.[174] Blockchain facilitates the transfer of information and/or assets instantaneously across the world among its network.[175] It was introduced in 1991 by Haber and Stornetta, who aimed to create a system that could record and distribute digital information in a way that cannot be altered.[176] In other words, blockchain is an immutable ledger. This technology is secure, efficient, programmable, and transparent.[177] Blockchain is constructed by

[174] Nolan Bauerle, "What is a Distributed Ledger?," *CoinDesk*, March 9, 2022, https://www.coindesk.com/learn/what-is-a-distributed-ledger/.
[175] Muddasar Ali and Sikha Bagui, "Introduction to NFTs: The Future of Digital Collectibles," *International Journal of Advanced Computer Science and Applications* 12, no. 10 (2021): 50.
[176] Vinay Gupta, "A Brief History of Blockchain," *Harvard Business Review*, February 28, 2017, https://hbr.org/2017/02/a-brief-history-of-blockchain.
[177] Ali and Bagui, "Introduction to NFTs," 50.

blocks of data (containing any type of information) connected by a 'chain,' which is the link between each block.[178] A new block is created when a transaction is requested. The block is sent to the network's participants who validate the transaction.[179] The block is then added to the blockchain, completing the transaction.[180] Each block contains the transaction's data, a unique identifier called a 'hash,' and the previous block's hash.[181] The hash from the previous block links the blocks together.[182] This prevents a block from being changed, or from new blocks being inserted between two directly linked blocks.[183] Therefore, blockchain is considered to be one of the most secure technologies.[184] Moreover, the network's participants are anonymous.[185] Third-party regulatory authority is not required as participants in this type of peer-to-peer network validate all transactions and are rewarded for the effort. The reward system employed by the blockchain is called 'proof of work'.[186]

A well-known application of blockchain is Bitcoin.[187] Bitcoin was introduced in 2008 to create a currency that does not need to be managed by a financial institution or controlled by a centralized issuer.[188] Bitcoin uses blockchain to record all transactions.

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[178] Ali and Bagui, "Introduction to NFTs," 50.
[179] Gupta, "A Brief History of Blockchain."
[180] "Blockchain," Goldman Sachs, accessed September 27, 2022, https://www.goldmansachs.com/insights/pages/blockchain/.
[181] Goldman Sachs, "Blockchain."
[182] Goldman Sachs, "Blockchain."
[183] Goldman Sachs, "Blockchain."
[184] Ali and Bagui, "Introduction to NFTs," 50.
[185] Ali and Bagui, "Introduction to NFTs," 50;
Mohit Kaushal and Sheel Tyle, "The Blockchain: What It Is and Why It Matters," *Brookings*, January 13, 2015, https://www.brookings.edu/blog/techtank/2015/01/13/the-blockchain-what-it-is-and-why-it-matters/.
[186] Kaushal and Tyle, "The Blockchain."
[187] Ali and Bagui, "Introduction to NFTs," 50.
[188] Ali and Bagui, "Introduction to NFTs," 50.

3.2 Ethereum

In 2015, a separate network Ethereum was introduced to improve on Bitcoin's capabilities.[189] Like Bitcoin, Ethereum uses blockchain technology to maintain its decentralized cryptocurrency 'Ether.' However, Ethereum's network of participants can also build other tamper-proof, decentralized applications on the blockchain, for example 'smart contracts.'[190] Smart contracts were originally introduced by computer scientist Nicholas Szabo, who aimed to create a method for verifying and executing digital negotiation and contracts.[191] Smart contracts exist on the Ethereum blockchain to store computer code that can automatically execute an agreement when predetermined conditions or terms are met.[192] In response to the use of smart contracts on Ethereum growing in popularity, a set of technical documents named 'Ethereum Request for Comments' (ERC) were developed to provide guidelines on creating a smart contract.[193] Encoded in smart contracts are 'tokens.' Simply put, a token is a digital asset stored on the blockchain. Tokens can include fungible tokens, such as a cryptocurrency, or non-fungible tokens, such as a one-of-a-kind collectible digital baseball card.

By 2017, Ethereum was gaining prominence and its growing user base was exploring the possibility of creative applications. In March 2017, a project named Peperium was created as a "meme marketplace and trading card game that allowed

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[189] Nathaniel Popper, "Ethereum, a Virtual Currency, Enables Transactions that Rival Bitcoin's," *The New York Times*, March 27, 2016, https://www.nytimes.com/2016/03/28/business/dealbook/ethereum-a-virtual-currency-enables-transactions-that-rival-bitcoins.html.
[190] "Intro to Ethereum," Ethereum, accessed September 27, 2022, https://ethereum.org/en/developers/docs/intro-to-ethereum/.
[191] Maria Vigliotti, "What Do We Mean by Smart Contracts? Open Challenges in Smart Contracts," *Frontiers*, February 3, 2021, https://www.frontiersin.org/articles/10.3389/fbloc.2020.553671/full.
[192] "An Introduction to Smart Contracts," An Introduction to Smart Contracts and Their Potential and Inherent Limitations, Harvard Law School Forum on Corporate Governance, accessed September 20, 2022, https://corpgov.law.harvard.edu/2018/05/26/an-introduction-to-smart-contracts-and-their-potential-and-inherent-limitations/.
[193] "Token Standards," Ethereum, accessed September 22, 2022, https://ethereum.org/en/developers/docs/standards/tokens/.

anyone to create memes."[194] A few months later, Cryptopunks were introduced – a project issuing 10,000 unique pixel characters generated on Ethereum's blockchain.[195] As a result of the rising interest in what could be defined as 'non-fungible tokens,' a new ERC was invented, called ERC-721. The ERC-721 standard outlined how to build NFTs.

The first NFT project using ERC-721 was CryptoKitties (in November 2017).[196] CryptoKitties is a blockchain game allowing Ethereum network participants to purchase, breed, and trade digital cats.[197] During the 2017 crypto bull market, CryptoKitties gained considerable popularity, eventually reaching mainstream news stations such as CNN.[198] Consequently, the network of Ethereum users began to realize the potential of NFTs.

3.3 NFTs

NFTs are strings of characters stored on a blockchain (such as Ethereum) and linked to a variety of digital assets. Blockchain is used to record and transfer ownership of NFTs.[199] NFTs are different from regular tokens, such as cryptocurrencies which are interchangeable and identical assets.[200] NFTs can be linked to images, audio, and video (among many other digital mediums), and may take the form of JPEGs or GIFs.[201] According to NFT market commentator Steve Kaczynski, and Professor of Business at Harvard Scott Kominers, "NFTs have fundamentally changed the market for digital assets," as they eliminate issues related

[194] Andrew Steinworld, "The History of Non-Fungible Tokens (NFTs)," accessed September 21, 2022, http://108.166.64.190/omeka222/files/original/453bc3985fdc186319dcaa6c0fcc9f8a.pdf.
[195] Steinworld, "The History of Non-Fungible Tokens (NFTs)."
[196] Steinworld, "The History of Non-Fungible Tokens (NFTs)."
[197] "CryptoKitties," OpenSea, accessed September 22, 2022, https://opensea.io/collection/cryptokitties.
[198] Steinworld, "The History of Non-Fungible Tokens (NFTs)."
[199] Yufei Xia, Jinglong Li, and Yating Fu, "Are non-fungible tokens (NFTs) different asset classes? Evidence from quantile connectedness approach," *Finance Research Letters* 49, no. 1 (2022): 1.
[200] Xia, Li and Fu, "Are non-fungible tokens (NFTs) different asset classes?," 1.
[201] Francis Russell, "NFTs and Value," *M/C Journal* 25, no. 2 (2022), https://doi.org/10.5204/mcj.2863.

to the infinite copy-making quality of the internet.[202] Before NFTs, it was nearly impossible to distinguish the true owner of a digital artwork from someone who simply saved and distributed it.[203] However, through the use of blockchain, NFTs enable tracking of a digital asset's ownership. Specialized marketplaces such as OpenSea – which now has more than one million users – have been developed for trading NFTs.[204] As NFTs' original ownership is recorded on the blockchain utilizing smart contract technology, NFTs may allow the original artist to earn resale royalties on all subsequent sales.[205] Original owners of NFTs are also able to determine the scarcity of the NFT, as they can choose how many original replications will exist.[206] New York Times technology columnist Kevin Roose notes "scarcity is what gives a lot of objects in the offline world their value… bringing this quality to the internet through NFTs … will unlock a whole new market for scarce digital goods."[207]

Although still in its infancy, the NFT market has shown significant growth since its inception. In the second quarter of 2022, NFT sales reached $8 billion with over one million active buyers in the market.[208] The average 24-hour trading volume for the NFT market has reached as high as $4.5 billion.[209] Coinciding with this growth is NFT's permeation within pop culture.[210] For example, celebrity NBA player Stephen Curry, musician Snoop Dogg, and supermodel Bella Hadid have all created NFT

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[202] Steve Kaczynski and Scott Duke Kominers, "How NFTs Create Value," *Harvard Business Review*, November 10, 2021, https://hbr.org/2021/11/how-nfts-create-value.
[202] Kevin Roose, "What are NFTs?," The New York Times, accessed September 21, 2022, https://www.nytimes.com/interactive/2022/03/18/technology/nft-guide.html.
[203] Kaczynski and Kominers, "How NFTs Create Value."
[204] Christian Pinto-Gutiérrez, et al., "The NFT Hype: What Draws Attention to Non-Fungible Tokens?," *Mathematic*s 10, no. 335 (2022): 1-2.
[205] Pinto-Gutiérrez, et al., "The NFT Hype," 1.
[206] Ali and Bagui, "Introduction to NFTs," 55.
[207] Roose, "What are NFTs?"
[208] NonFungible.com, *Quarterly NFT Market Report: Q2 2022* (Palmerston, Canada: NonFungible, 2022), 17.
[209] Qin Wang, et al., "Non-Fungible Token (NFT): Overview, Evaluation, Opportunities and Challenges," (Essay, Southern University of Science and Technology, 2021), 2.
[210] Kaczynski and Kominers, "How NFTs Create Value."

projects to capitalize on this lucrative market.[211] Further, in 2022 Starbucks announced an NFT initiative, Mastercard began allowing purchases on several NFT marketplaces, and eBay acquired the NFT marketplace KnownOrigin.[212] Academics and NFT researchers De-Rong Kong and Tse-Chun Lin note "the usage of NFTs has evolved from niche blockchain communities into daily business sectors."[213] The popularity of NFTs is evident in this asset's extraordinary sale prices, outlined below in Table 7.

Table 7: Top three most expensive NFTs (June 2022)

Rank	Artist	Name	Sale price (million USD)	Description
1	Pak	*The Merge*	91.8	Series of images with circles of different sizes representing different masses. Circle size grows the more amount of NFTs in the series purchased by the owner.
2	Beeple	*Everydays: The First 5000 Days*	69.3	Collage of 5000 digital images created by Beeple.
3	Julian Assange and Pak	*Clock*	52.7	Digital counter of the days Julian Assange has been incarcerated.

Source: data from Sensorium, 10 Most Expensive NFTs Ever Sold [June 2022 Update]," accessed September 27, 2022, https://sensoriumxr.com/articles/most-expensive-nft-sales.

In 2021, top-tier art auction houses began embracing art and collectibles NFTs. In March of 2021, Christie's sold its first NFT *Everydays: The First 5000 Days* by digital artist Beeple for $69 million.[214] Following the Beeple sale, in April of 2021 Sotheby's held its first NFT auction featuring works by digital artist Pak, achieving a

[211] Nicolette Salmi, "13 Celebrities Who Have Joined the NFT Crypto Art Craze," *L'Officiel USA,* September 29, 2022, https://www.lofficielusa.com/pop-culture/celebrities-on-the-crypto-art-craze; Kaczynski and Kominers, "How NFTs Create Value."
[212] Nonfungible.com, *Quarterly NFT Market Report: Q2 2022*, 14.
[213] De-Rong Kong and Tse-Chun Lin, "Alternative Investments in the Fintech Era: The Risk and Return of Non-fungible Token (NFT)," (Essay, National Taiwan University and The University of Hong Kong, 2021), 1.
[214] Kaczynski and Kominers, "How NFTs Create Value."

net profit of $17 million.[215] By the end of the year Sotheby's had launched its own NFT marketplace 'Metaverse,' and in September of 2022 Christie's announced the launch of 'Christie's 3.0' for its NFT sales.[216] It comes as no surprise that the artworld's largest secondary market players, auction houses, entered the secondary NFT market – NFT's accessible entry prices, instant tradability, and increasing resale prices have catalyzed high demand for resale platforms. Economist Clare McAndrew asserts investors are "trading in and out of NFTs at a much more rapid pace than would ever have been possible in the traditional secondary art market."[217]

In essence, art and collectible NFTs are no more than a string of code.[218] For some, this means NFTs have no underlying value. However, the same criticism can in part be applied to the traditional art market. For example, one could question whether Maurizio Cattelan's work *Comedian* (2019), consisting of a banana duct-taped to a wall, was worth $120,000.[219] For others, the unique code of an NFT is ascribed value based on its scarcity and provenance.[220] These factors are considered valuable enough for the NFT art and collectibles market to reach a combined $11 billion in 2021.[221] Participants in the NFT market also include investors, such as hedge funds, seeking an alternative asset, suggesting NFTs are considered by some as a legitimate and valuable investment option.[222]

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[215] Eileen Kinsella, "Sotheby's Nets $17 Million With Its First-Ever NFT Auction (Which Included Almost 20,000 Very Fungible Works)," *Artnet News,* April 15, 2021, https://news.artnet.com/market/sothebys-first-ever-sale-of-nfts-pak-and-nifty-gateway-1959276.
[216] Shanti Escalante-De Mattei, "Sotheby's Launches an NFT-Only Marketplace," *ARTNews,* October 19, 2021, https://www.artnews.com/art-news/market/sotheby-metaverse-nft-only-marketplace-1234607430/;
"The A-Z of NFT: artists and terminology to know," Christie's, accessed September 27, 2022, https://www.christies.com/features/a-to-z-nft-collecting-guide-12425-1.aspx?sc_lang=en.
[217] McAndrew, *The Art Market 2022*, 43.
[218] Wang, et al., "Non-Fungible Token (NFT)," 2.
[219] Russell, "NFTs and Value."
[220] Russell, "NFTs and Value."
[221] McAndrew, *The Art Market 2022*, 42.
[222] Xia, Li and Fu, "Are non-fungible tokens (NFTs) different asset classes?," 1.

4 Characteristics of NFTs as an investment

4.1 Market efficiency

The NFT market is substantially more transparent and liquid and involves considerably lower transaction costs than the traditional art market.[223] As the NFT market is relatively new, efficiency improvements are likely with maturation.[224] This section compares the efficiency of the NFT art and collectibles market with that of the traditional art market.

4.1.1 Market transparency

Ethereum NFT marketplaces are characterized by high transparency.[225] Smart contracts are designed to regulate, record, and make transparent all information relating to an NFT transaction. Therefore, NFT marketplaces, such as OpenSea, can disclose NFT properties and ownership details, such as bids, offers, trading dates, changes in ownership, and information about transacting parties.[226] Unlike trades in the artworld, this information is available in both the primary and secondary NFT markets.[227] Accordingly, NFT marketplaces function more like conventional marketplaces, such as equity markets, which display an order book with bids, offers, and trade times. Kong and Lin argue these features of the NFT market "permit us to analyze NFTs at the transaction level," a significant benefit to the NFT market when compared to the art market.[228] This is also made possible by the abundance of market data and data tracking platforms, such as NonFungible.com. Transparency in the NFT

[223] Giulio Anselmi and Giovanni Patrella, "Non-Fungible Token Artworks: More Crypto than Art?," (Essay, Catholic University of the Sacred Heart, 2022), 7.
[224] Rachel Schonbaum, "Decentraland NFT (LAND) Market Efficiency & Responsiveness to Events," (Master's thesis, Michigan Ross, 2022), 25.
[225] Luisa Schaar and Stylianos Kampakis, "Non-fungible Tokens as an Alternative Investment: Evidence from CryptoPunks," *The Journal of The British Blockchain Association* 5, no. 2 (2022): 2.
[226] Kong and Lin, "Alternative Investments in the Fintech Era," 3;
Raeesah Chohan and Jeannette Paschen, "NFT marketing: How marketers can use nonfungible tokens in their campaigns," *Business Horizons* 1, no.1 (2021): 1.
[227] Kong and Lin, "Alternative Investments in the Fintech Era," 3.
[228] Kong and Lin, "Alternative Investments in the Fintech Era," 3.

market allows investors to understand and manage the risk inherent in trading this asset, enabling informed investment decisions. This also helps reduce the required insider knowledge and uncertainty involved in participating in a high-risk market. Additionally, newly established art investment funds with little art-market expertise (such as Fernwood, which was unable to convince investors of the fund's ability to overcome the art market's information asymmetry) may be more likely to raise capital investing in a transparent sector of the industry.

4.1.2 Market liquidity and seasonality

The NFT market is characterized by low liquidity compared to traditional assets.[229] As an NFT is a unique and unconventional asset within a nascent market, its pool for potential buyers is limited and it can be difficult for transacting parties to agree on a value.

An NFT can also be confined to just one blockchain, for example, Ethereum. If so, it cannot be traded on another network which further limits the market's liquidity. Worsening this issue is the difficulty in assessing liquidity in the NFT market. In many cases, NFTs are traded in the form of swaps rather than cryptocurrency or cash.[230] Swapping involves the trading of an NFT for an equally valued NFT from another collection and enables investors to circumvent the fees associated with buying and selling on NFT marketplaces.[231] Without a cash transaction, liquidity (which measures the efficiency at which an asset can be exchanged for cash) cannot be measured.

The crypto world is exploring innovative projects that will introduce liquidity to the NFT market – for example, NFTX, which is "a platform for creating liquid

[229] Schaar and Kampakis, "Non-fungible Tokens as an Alternative Investment," 2.
[230] "A Deeper Dive into NFTs: NFT Swapping and Bridging," LeewayHertz, accessed December 6, 2022, https://www.leewayhertz.com/nft-swapping-and-bridging/.
[231] LeewayHertz, "A Deeper Dive into NFTs."

markets for illiquid non-fungible tokens."[232] NFTX allows users to deposit an NFT collection into a vault to receive an ERC-20 token which can then be used as a tradable product in the broader decentralized finance ecosystem.[233] This concept is similar to art lending and enables users to utilize NFT collections as collateral to unlock liquidity.

Unlike the art market, the NFT market is still in its infant stage and has considerable room for growth. In the span of just two years, 2019 to 2021, the total number of active buyers on art-based NFT platforms increased from 1,300 to 131,000.[234] As the market continues to mature it is likely to gain more active participants, market depth, and liquidity.

Moreover, despite the sentimental or hedonistic value of NFTs to some collectors, the average resale period for NFTs is 48 days.[235] This is significantly shorter than the average resale time on art, which is 25 to 30 years.[236] Further, one major advantage of NFT investment is the availability of the market. Unlike traditional markets, NFT markets are open 24/7 and are not seasonal, allowing participants to list or purchase an item at any desired time.[237] The absence of a central entity in the NFT market also allows NFT investors to negotiate and trade with counterparties directly and whenever most convenient.[238] Kong and Lin believe this "reduces deadweight loss in illiquid asset markets." [239] Moreover, ownership and authenticity are instantly validated in the NFT market, eliminating the need for an intermediary in trade (such as an auction house) to prove the asset's legitimacy. This

[232] "Introduction to NFTX," Docs.NFTX, accessed October 3, 2022, https://docs.nftx.io/.
[233] "NFTX - NFT Index Funds Explained," DeFi Prime, accessed October 3, 2022, https://defiprime.com/nftx.
[234] McAndrew, *The Art Market 2022*, 42.
[235] Nonfungible.com, *Quarterly NFT Market Report: Q2 2022*, 17.
[236] McAndrew, *The Art Market 2022*, 46.
[237] Schaar and Kampakis, "Non-fungible Tokens as an Alternative Investment," 2.
[238] Kong and Lin, "Alternative Investments in the Fintech Era," 3.
[239] Kong and Lin, "Alternative Investments in the Fintech Era," 3.

is supported by Professor of Finance at Tilburg University Mieszko Mazur, who asserts "it is more efficient to trade assets, if the ownership can be instantaneously proven and transferred."[240]

4.1.3 Friction costs

Interacting with a blockchain is not free. Ethereum's fees are based on a concept called 'gas' which is a measure of the computational power or 'fuel' required for using blockchain technology.[241] In other words, gas fees are the amount of computing energy required to validate and record transactions on the blockchain and are dependent on the number and type of computations. For example, the use of smart contracts is computationally intensive.[242] Gas fees compensate blockchain miners for computing energy. Ethereum gas fees are charged in units called gigawei. One gigawei equals one billionth of an ETH.[243] The basic equation for calculating a gas fee on Ethereum is:

$$Total\ gas\ fee = gas\ units \times (base\ fee + tip)$$

The gas unit is the maximum amount a user will pay to have a transaction added to a block on the Ethereum blockchain.[244] The base fee equates to the amount of gas a given activity requires to be processed.[245] This is dependent on the network's user demand.[246] If user demand is high, the base fee will increase for all users. The tip is the amount of gigawei the user is willing to spend to have a transaction prioritized by validators.[247] Transactions with low gas fees are not prioritized by validators.

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[240] Mieszko Mazur, "Non-Fungible Tokens (NFT). The Analysis of Risk and Return," (Essay, IESEG School of Management, 2021), 6.
[241] "Gas and fees," Ethereum, accessed November 8, 2022, https://ethereum.org/en/developers/docs/gas/.
[242] Ethereum, "Gas and fees."
[243] Ethereum, "Gas and fees."
[244] Ethereum, "Gas and fees."
[245] Ethereum, "Gas and fees."
[246] Ethereum, "Gas and fees."
[247] Ethereum, "Gas and fees."

As Ethereum has limited capacity, more people participating in its network results in greater congestion, therefore, increasing gas fees. As it continues to grow, its network fees will also increase.[248]

However, transaction fees on these platforms are significantly lower than fees from trading art. Kong and Lin find average gas fees account for 0.2% of NFT sale prices.[249] Additionally, OpenSea currently charges 2.5% per transaction.[250] Compare this figure to the 25% commission charged by art auction houses.[251] Through trading NFTs, art investment funds could lower management fees for investors.

4.2 Market characteristics

This section addresses further characteristics of the NFT market to assess the viability of NFTs as an asset relative to tangible art.

4.2.1 Determinants of price

Like art, an NFTs price cannot be determined using a single pricing model. This contributes to uncertainty within the market as investors are less able to predict an NFT's value. However, the resulting uncertainty is less extreme than in the art market, as NFT prices are visible to investors allowing for better-informed investment decisions.

There are known drivers of NFT value which can help estimate NFT prices. These drivers can be categorized into 'sentimental' or 'functional' factors.

a. Sentimental factors

An NFT's price is largely dependent on the popularity and fame of its creator. Consider Twitter founder Jack Dorsey's sale of his first tweet as an NFT for $2.9

[248] Ethereum, "Gas and fees."
[249] Kong and Lin, "Alternative Investments in the Fintech Era," 4.
[250] "What are service and creator fees?," OpenSea, accessed October 5, 2022, https://support.opensea.io/hc/en-us/articles/1500011590241-What-are-service-and-creator-fees-#:~:text=OpenSea's%20service%20fees,for%20free%20at%20any%20time.
[251] artprice, "Buyer's premium."

million, or Beeple's sale of *Everydays: The First 5000 Days* for $69.9 million.[252] Both creators are considered celebrities and would likely not have received the same attention and profit if they were unknown artists. Furthermore, according to Kong and Lin, an NFT's price is also determined by its supply – "we find that NFT prices highly depend on a token's scarceness."[253] For example, the price of CryptoPunks increases with rareness. CryptoPunks are categorized into five major types – Alien, Ape, Zombie, Female, and Male.[254] There are only nine, 24, and 88 tokens for the Alien, Ape, and Zombie respectively among the entire collection.[255] The average price of a CryptoPunk is currently $140,000, however, the rarest can be priced up to $23 million, such as CryptoPunk #5822 featuring an alien in a bandana.[256] Another NFT value-added factor is provenance and the identity of previous owners.[257] A well-known collector's investment in an NFT will likely increase its desirability and therefore increase its value. Hedonic value embedded in NFT investment such as the enjoyment of completing an NFT collection can also influence an NFTs price.[258] Further, an NFT's age may also be a price determinant. For example, CryptoPunks are considered valuable insofar as they are one of the oldest NFT projects, and therefore hold historical significance.[259] Finally, a fractionalized NFT's (an NFT separated into smaller parts functioning like shares or stocks of a company) divided pieces may have different prices depending on the distinctive feature present. For example, hypothetically if a CryptoPunk were to be fractionalized, one investor may

[252] Ben Davis, "A Crypto-Collector's Attempt to Flip the NFT of Jack Dorsey's First-Ever Tweet—for Which He Paid $2.9 Million—Flops Big-Time," *Artnet,* April 15, 2022, https://news.artnet.com/market/attempt-to-flip-nft-first-tweet-flops-2099625.
[253] Kong and Lin, "Alternative Investments in the Fintech Era," 4.
[254] Kong and Lin, "Alternative Investments in the Fintech Era," 12.
[255] Kong and Lin, "Alternative Investments in the Fintech Era," 12.
[256] "CryptoPunks," Larva Labs, accessed October 11, 2022, https://www.larvalabs.com/cryptopunks.
[257] Russell, "NFTs and Value."
[258] Schaar and Kampakis, "Non-fungible Tokens as an Alternative Investment," 2.
[259] Russell, "NFTs and Value."

own the face of the CryptoPunk image (more valuable), whilst another investor may own the background (less valuable).

b. Functional factors

The value of an NFT is also determined by the asset it represents on the blockchain. If an NFT is linked to a tangible asset, its 'real world' prices are reflected in its NFT price. For example, Nike recently released a collection of shoes attached to the metaverse named CryptoKicks, which investors are paying up to roughly $134,000 for, in addition to the NFT.[260] The NFT's value would likely be lower if it was solely a digital asset. This notion also applies to the functionality and utility of an NFT. Utility tokens – designed to give owners certain benefits, such as event entry, access to messaging boards, or subscription-style benefits – are expected to add value beyond the metaverse aesthetic for an owner.

Other drivers of NFT prices include economic conditions, regulation policies, public skepticism, and the level of active transactions and attention to the NFTs native blockchain.[261] Kong and Lin's findings demonstrate movements in an NFT index are positively correlated with its native cryptocurrency and the stock market, meaning investors will increase investment in NFTs when aggregate wealth increases.[262]

4.2.2 Risk-return profile

a. Returns

Like fine art, NFTs are heterogeneous goods in an illiquid market (relative to bonds and equities), preventing accurate analysis and comparison of returns between different NFTs and assets. However, this issue is less severe in the NFT market than

[260] Alex Williams, "Nike Sold an NFT Sneaker for $134,000," *The New York Times,* May 26, 2022, https://www.nytimes.com/2022/05/26/style/nike-nft-sneaker.html.
[261] Kong and Lin, "Alternative Investments in the Fintech Era," 4-14.
[262] Kong and Lin, "Alternative Investments in the Fintech Era," 4-14.

in the art market, as NFTs are significantly more liquid than art. Several studies mention the use of an HR method, therefore addressing some heterogeneity in NFTs.

Further, as expected in an embryonic market, academic research on the investment returns of NFT art and collectibles is incomplete and limited. Analysis is restricted to a small sample size with small observation periods, differing study methodologies, and inconsistent results. Academic studies vary in periods studied, type of analysis, and whether data is collected from secondary or primary markets. Additionally, some studies do not mention this information in the explanation of methodology. This is shown below in Table 8. It is important to consider these limitations when assessing the NFT market's returns.

Table 8: Selected academic studies on NFTs

Date	**Author**	**Primary/ secondary**	**Analysis**	**Geometric/ arithmetic**	**Net/ gross**	**Observation**
01/2020-12/2021	Umar, Abrar, Zaremba, Teplovaf, Vo	N.D.	N.D.	N.D.	N.D.	N.D.
04/2018-01/2022	Umar, Alwahedi, Zaremba, Vo	N.D.	N.D.	N.D.	N.D.	Daily
01/2018-08/2021	Anselmi, Petrella	Secondary	N.D.	N.D.	N.D.	Weekly
03/2019-03/2022	Dowling	Secondary	N.D.	N.D.	N.D.	Weekly
12/2019-06/2020	Ko, Son, Lee, Jang, Lee	N.D.	N.D.	Arithmetic	N.D.	Weekly
06/2017-03/2022	Kong, Lin	Both	Hedonic regression model	Geometric	Gross	Monthly
06/2018-05/2021	Schaar, Kampakis	Secondary	Hedonic regression model	N.D.	Gross	Monthly

Sources: data from De-Rong Kong and Tse-Chun Lin, "Alternative Investments in the Fintech Era: The Risk and Return of Non-fungible Token (NFT)," (Essay, National Taiwan University and The University of Hong Kong, 2021), 1-22; Giulio Anselmi and Giovanni Patrella, "Non-Fungible Token Artworks: More Crypto than Art?,"

(Essay, Catholic University of the Sacred Heart, 2022), 7; Hyungjin Ko, et al., "The economic value of NFT: Evidence from a portfolio analysis using mean–variance framework," *Finance Research Letters* 47, no. 1 (2022): 1-4; Michael Dowling, "Is non-fungible token pricing driven by cryptocurrencies?," *Finance Research Letters* 44, no. 1 (2021): 1-4; Luisa Schaar and Stylianos Kampakis, "Non-fungible Tokens as an Alternative Investment: Evidence from CryptoPunks," *The Journal of The British Blockchain Association* 5, no. 2 (2022): 1-4; Zaghum Umar et al., "Return and volatility connectedness of the non-fungible tokens segments," *Finance Research Letters* 35, no. 1 (2022): 1-4; Zaghum Umar et al., "The Return and Volatility Connectedness of NFT Segments and Media Coverage: Fresh Evidence Based on News About the COVID-19 Pandemic," *Finance Research Letters* 49, no. 1 (2022): 1-5.

Table 9 below outlines the results from studies on art and collectibles NFT returns. The greatest annualized returns are found in studies of the investment performance of CryptoPunks, ranging from 2.1% to 19.1%. However, the entire NFT collectibles market on the Ethereum network was found to have average annualized returns of only 0.2% between April 2018 and January 2022. Similarly, the average annual returns for the NFT art market were 0.2% for the same period. Between 2018 and 2021, the art and collectibles NFT market combined achieved annual returns of 1.3%.

Table 9: Results from academic studies on the rate of return of NFT art and collectibles

Asset category	**Date**	**Author**	**Object**	**Block-chain**	**Market-place**	**Return (%)**	**Annual-ized return (%)**
Art	01/2020-12/2021	Umar, Abrarc, Zaremba, Teplovaf, Vo	N.D.	N.D.	N.D.	1.24	--
Art	04/2018-01/2022	Umar, Alwahedi, Zaremba, Vo	All	Ethereum	All	0.78	0.21
Art and collectibles	01/2018-08/2021	Anselmi, Petrella	All	Ethereum	OpenSea	4.57	1.25
Collectibles	03/2019-03/2022	Dowling	Crypto-Punks	Ethereum	N.D.	6.49	2.12

Collectibles	12/2019-06/2020	Ko, Son, Lee, Jang, Lee	Crypto-Punks	Ethereum	N.D.	9.12	19.07
Collectibles	06/2017-03/2022	Kong, Lin	Crypto-Punks	Ethereum	All	16.93	3.35
Collectibles	06/2018-05/ 2021	Schaar, Kampakis	Crypto-Punks	Ethereum	All	34.19	10.61
Collectibles	01/2020-12/2021	Umar, Abrarc, Zaremba, Teplovaf, Vo	N.D.	N.D.	N.D.	1.56	--
Collectibles	04/2018-01/2022	Umar, Alwahedi, Zaremba, Vo	All	Ethereum	All	0.56	0.15

Sources: data from De-Rong Kong and Tse-Chun Lin, "Alternative Investments in the Fintech Era: The Risk and Return of Non-fungible Token (NFT)," (Essay, National Taiwan University and The University of Hong Kong, 2021), 47, table 7; Giulio Anselmi and Giovanni Patrella, "Non-Fungible Token Artworks: More Crypto than Art?," (Essay, Catholic University of the Sacred Heart, 2022), 17, table 2; Hyungjin Ko, et al., "The economic value of NFT: Evidence from a portfolio analysis using mean–variance framework," *Finance Research Letters* 47, no. 1 (2022): 3, table 1; Michael Dowling, "Is non-fungible token pricing driven by cryptocurrencies?," *Finance Research Letters* 44, no. 1 (2021): 2, table 1; Luisa Schaar and Stylianos Kampakis, "Non-fungible Tokens as an Alternative Investment: Evidence from CryptoPunks," *The Journal of The British Blockchain Association* 5, no. 2 (2022): 10, table 8; Zaghum Umar et al., "Return and volatility connectedness of the non-fungible tokens segments," *Finance Research Letters* 35, no. 1 (2022): 2, table 1; Zaghum Umar et al., "The Return and Volatility Connectedness of NFT Segments and Media Coverage: Fresh Evidence Based on News About the COVID-19 Pandemic," *Finance Research Letters* 49, no. 1 (2022): 3, table 1.

82% of NFT resales (up to 2022) have been profitable, and total profits from resale ($1 billion) exceeded total losses ($65.8 million) in 2021.[263]

Table 10 below lists the top 10 most profitable NFT projects in the second quarter of 2022.[264]

Table 10: Top 10 most profitable NFT projects in Q2 2022[265]

Segment	**Project**	**Profit (million USD)**	**Average resale profit (USD)**	**Rate of resale at profit**
Metaverse	Otherside	300.34	4,427	89%

[263] McAndrew, *The Art Market 2022,* 46.
[264] *Quarterly NFT Market Report: Q2 2022,* 41.
[265] *Quarterly NFT Market Report: Q2 2022,* 41.

Collectibles	Moonbirds	224.76	14,331	93%
Collectibles	Bored Ape Yacht Club	132.80	49,730	58%
Collectibles	Azuki	35.84	8,410	66%
Utilities	Ethereum Name Service	32.34	52	98%
Collectibles	Goblin Town	26.78	1,234	83%
Collectibles	Doodles	26.40	12,133	68%
Utilities	Proof Collective	21.93	94,390	80%
Collectibles	Phanton Network	14.93	1,881	75%
Collectibles	Chimpers	11.75	1,792	90%

Source: data from NonFungible.com, *Quarterly NFT Market Report: Q2 2022* (Palmerston, Canada: NonFungible, 2022), 41, figure 13.

b. Volatility

Table 11 highlights the standard deviation of returns for the NFT assets in the studies mentioned above. All NFT markets analyzed have a high standard deviation, but the highest results are found among studies of Cryptopunks. However, as NFTs are an illiquid market, volatility measures may not be accurate.

Table 11: Results from academic studies on the volatility of NFT art and collectibles

Asset category	**Date**	**Author**	**Research object**	**Block-chain**	**Market-place**	**Observ-ation**	**Stdev. (%)**
Art	01/2020-12/2021	Umar, Abrar, Zaremba, Teplovaf, Vo	N.D.	N.D.	N.D.	N.D.	15.16
Art	04/2018-01/2022	Umar, Alwahedi, Zaremb, Vo	All	Ethereum	All	Daily	23.42
Art and collectibles	01/2018-08/2021	Anselmi, Petrella	All	Ethereum	OpenSea	Weekly	46.01
Collectibles	03/2019-03/2022	Dowling	Crypto-Punks	Ethereum	N.D.	Weekly	62.03
Collectibles	12/2019-06/2020	Ko, Son, Lee, Jang, Lee	Crypto-Punks	Ethereum	N.D.	Weekly	47.06
Collectibles	06/2017-03/2022	Kong, Lin	Crypto-Punks	Ethereum	All	Monthly	66.17
Collectibles	06/2018-05/ 2021	Schaar, Kampakis	Crypto-Punks	Ethereum	All	Monthly	61.76

Collectibles	01/2020-12/2021	Umar, Abrar, Zaremba, Teplovaf, Vo	N.D.	N.D.	N.D.	N.D.	20.44
Collectibles	04/ 2018-01/2022	Umar, Alwahedi, Zaremba, Vo	All	Ethereum	All	Daily	11.92

Note: 'Stdev' is an abbreviation of standard deviation.
Sources: data from De-Rong Kong and Tse-Chun Lin, "Alternative Investments in the Fintech Era: The Risk and Return of Non-fungible Token (NFT)," (Essay, National Taiwan University and The University of Hong Kong, 2021), 47, table 7; Giulio Anselmi and Giovanni Patrella, "Non-Fungible Token Artworks: More Crypto than Art?," (Essay, Catholic University of the Sacred Heart, 2022), 17, table 2; Hyungjin Ko, et al., "The economic value of NFT: Evidence from a portfolio analysis using mean–variance framework," *Finance Research Letters* 47, no. 1 (2022): 3, table 1; Michael Dowling, "Is non-fungible token pricing driven by cryptocurrencies?," *Finance Research Letters* 44, no. 1 (2021): 2, table 1; Luisa Schaar and Stylianos Kampakis, "Non-fungible Tokens as an Alternative Investment: Evidence from CryptoPunks," *The Journal of The British Blockchain Association* 5, no. 2 (2022): 10, table 8; Zaghum Umar et al., "Return and volatility connectedness of the non-fungible tokens segments," *Finance Research Letters* 35, no. 1 (2022): 2, table 1; Zaghum Umar et al., "The Return and Volatility Connectedness of NFT Segments and Media Coverage: Fresh Evidence Based on News About the COVID-19 Pandemic," *Finance Research Letters* 49, no. 1 (2022): 3, table 1.

c. Comparison with conventional markets

Table 12 compares the returns, standard deviation, and Sharpe ratio of NFTs and traditional assets.

Table 12: Risk-return characteristics of NFTs versus traditional assets

Author	**Time period**	**Observation**	**Asset**	**Annualized returns (%)**	**Stdev (%)**	**Sharpe ratio (%)**
Anselmi, Petrella	01/2018-08/2021	Weekly	NFT art and collectibles	1.25	46.00	--
			S&P 500	0.16	5.20	--
Ko, Son, Lee, Jang, Lee	12/2019-06/2020	Weekly	CryptoPunks	19.07	47.06	--
			S&P 500	0.88	3.52	--
			Bond index	0.20	1.89	--
			Commodity index	0.58	3.17	--
			Gold	0.66	2.59	--
Schaar, Kampakis	06/2018-05/ 2021	Monthly	CryptoPunks	10.61	61.76	53.38
			T-Bill	0.42	1.00	--

			10-Year U.S. Bond	-0.14	15.54	10.41
			World Equity	0.40	5.27	-1.13
			U.S. Equity	0.49	5.45	4.28
			U.S. Real Estate REIT	0.35	5.48	-3.61
Kong, Lin	06/2017-03/2022	Monthly	CryptoPunks	3.35	66.17	25.45
			NASDAQ	0.29	4.51	28.78
			S&P500	0.22	3.73	25.54
			Dow Jones	0.17	3.84	19.18
			Bond	0.01	14.02	-0.23
			Gold	0.14	2.90	20.20
			One-month T-bill	0.02	8.00	--

Note: 'Stdev' is an abbreviation of standard deviation. Standard deviation has not been changed from the original paper's results.
Sources: data from De-Rong Kong and Tse-Chun Lin, "Alternative Investments in the Fintech Era: The Risk and Return of Non-fungible Token (NFT)," (Essay, National Taiwan University and The University of Hong Kong, 2021), 47, table 7; Giulio Anselmi and Giovanni Patrella, "Non-Fungible Token Artworks: More Crypto than Art?," (Essay, Catholic University of the Sacred Heart, 2022), 17, table 2; Hyungjin Ko, et al., "The economic value of NFT: Evidence from a portfolio analysis using mean–variance framework," *Finance Research Letters* 47, no. 1 (2022): 3, table 1; Luisa Schaar and Stylianos Kampakis, "Non-fungible Tokens as an Alternative Investment: Evidence from CryptoPunks," *The Journal of The British Blockchain Association* 5, no. 2 (2022): 10, table 8.

The authors find NFTs outperform all conventional assets during the studied periods. However, these studies also calculate substantially greater volatility in NFT markets. The Sharpe ratio of 53.4% for CryptoPunks found in machine-learning data scientists Luisa Schaar and Stylianos Kampakis' study suggests CryptoPunks generate strong returns per unit of risk, especially when compared to traditional assets. The opposite is found by Kong and Lin, who calculate a Sharpe Ratio of 25.5% which is less than the Sharpe ratio of NASDAQ, and only marginally greater than the S&P500s.

Like art, NFTs offer investors emotional returns in social status and recognition.[266] This is supported in Kong and Lin's study, where the authors claim

[266] Kong and Lin, "Alternative Investments in the Fintech Era," 10.

55.3% of CryptoPunk investors have not resold their NFT due to the emotional returns they are receiving.[267] Kong and Lin believe investors are more willing to accept extreme volatility in NFT investments to reap these psychic benefits.[268]

d. Diversification

Of the studies included in the NFT return and volatility examination above, Professors of Finance (at Università Cattolica del Sacro Cuore) Giulio Anselmi and Giovanni Petrella, and Schaar and Kampakis offer an analysis of NFT diversification characteristics. Anselmi and Petrella find a correlation coefficient of 0.2 between the S&P500 and the art and collectibles NFT market.[269] This is a positive but weak correlation. For investors, this level of correlation is acceptable for portfolio diversification.[270] Schaar and Kampakis' World Equity, U.S. Equity, and U.S. Real Estate indices all exhibit near-zero correlation coefficients with CryptoPunks, as shown below.

Table 13: Schaar and Kampakis, correlation of art's returns with traditional assets

Variables	**Crypto Punks**	**T-Bill**	**10-Year U.S. Bond**	**World Equity**	**U.S. Equity**	**U.S. Real Estate**
CryptoPunks	1	-0.44	0.36	0.04	0.02	0.13
T-Bill		1	-0.27	-0.21	-0.21	-0.06
10-Year U.S. Bond			1	0.40	0.38	0.30
World Equity				1	0.99	0.83
U.S. Equity					1	0.82
U.S. Real Estate						1

Source: data from Luisa Schaar and Stylianos Kampakis, "Non-fungible Tokens as an Alternative Investment: Evidence from CryptoPunks," *The Journal of The British Blockchain Association* 5, no. 2 (2022): 10, table 9.

[267] Kong and Lin, "Alternative Investments in the Fintech Era," 13.
[268] Kong and Lin, "Alternative Investments in the Fintech Era," 33.
[269] Anselmi and Patrella, "Non-Fungible Token Artworks", 18.
[270] Schaar and Kampakis, "Non-fungible Tokens as an Alternative Investment," 10.

At the time of this thesis submission, a research paper on an NFT efficient frontier has not been published. Therefore, it is undetermined whether NFTs make an appropriate portfolio diversification tool.

e. Inflationary hedge

As the NFT market emerged within the last five years and has only experienced one inflationary period (ongoing as of December 2022), the market's relationship with inflation cannot yet be determined. Additionally, it is difficult to distinguish between inflation's effect on NFT prices and the volatility of the market given the current market crash (discussed in later sections).

4.2.3 Market regulation

The high profitability and unregulated practices involved in NFT trading have encouraged illegal or dubious activity. McAndrew states "NFT platforms are generally unregulated … allowing transactions that would not be permitted in other financial markets."[271]

Unlike the artworld, sellers in the NFT market are not audited on a 'know your customer' basis before they make a sale. Therefore, there is greater potential for fraudulent transactions.[272] Many NFT platforms allow free, unlimited minting of new NFTs, enabling anyone, including bots, to create a file and turn it into an NFT.[273] This can happen without the seller having rights to the content and without having to prove ownership of the original image.[274] In the U.S., platforms are subject to copyright laws – such as the 1996 WIPO Copyright Treaty and the 1998 Digital Millennium Copyright Act – requiring the original owner of the copyrighted work be made aware

[271] McAndrew, *The Art Market 2022*, 46.
[272] McAndrew, *The Art Market 2022*, 47.
[273] McAndrew, *The Art Market 2022*, 47.
[274] McAndrew, *The Art Market 2022*, 47.

of the infringement, and that the copyrighter is sent notice to remove the material.[275] However, intellectual property infringements are difficult to discover and fight in NFT markets. Additionally, despite platforms banning known infringers, infringers can continue to operate due to the anonymity of these decentralized platforms.[276]

Another security risk is 'spoofing,' which occurs when a user attempts to sell an NFT and an attacker illegally transfers the NFT's ownership by exploiting authentication weaknesses or the user's private key.[277] A user is also at risk of 'tampering,' which refers to the modification of NFT data by an attacker. Although data on the blockchain cannot be modified after the transaction is confirmed, data stored outside the blockchain, or 'off-chain', can be manipulated.[278] Very few NFT projects are stored entirely 'on-chain,' as they contain large amounts of data which results in high gas fees.

Additionally, issues may arise from 'wash trading.' This practice involves the trading of an NFT between accounts operated by the same owner to make an NFT appear demanded and more valuable, in turn inflating its market price.[279] Wash trading is illegal in the U.S. but has not been regulated or enforced on NFT platforms.[280]

Furthermore, inconsistencies among different countries and government regulation on NFTs presents challenges in the market. In India and China, regulation surrounding NFTs and cryptocurrency trading is strict.[281] Several countries, such as France and Malta, are in the process of implementing laws to regulate digital asset

[275] McAndrew, *The Art Market 2022*, 47.
[276] McAndrew, *The Art Market 2022*, 47.
[277] Wang, et al., "Non-Fungible Token (NFT)," 9.
[278] Wang, et al., "Non-Fungible Token (NFT)," 9.
[279] McAndrew, *The Art Market 2022*, 46.
[280] McAndrew, *The Art Market 2022*, 46.
[281] Wang, et al., "Non-Fungible Token (NFT)," 14-15.

services, whilst other jurisdictions are applying existing laws.[282] Internationally, NFT market participants are required to overcome complex or contradictory governance surrounding NFT markets.[283]

The aforementioned issues are likely to create volatility, instability, and risk aversion in the NFT market. This undermines the confidence of NFT platform participants and may inhibit future growth in the market.[284]

4.2.4 The Covid-19 pandemic

As NFTs are considered an alternative asset, in theory, the market should have grown during Covid-19 as investors searched for yield in a low interest rate environment. Kong and Lin find NFT returns rose from 6% pre-Covid-19 to 32.5% in the post-Covid-19 period.[285] However, the standard deviation of returns also drastically increased to 82.3%.[286] Academics David Aharon and Ender Demir, and Zaghum Umar, Mariya Gubarev, Tamara Teplov, and Dang Tran, also find that during the Covid-19 period, short-run NFT investment absorbed risk.[287] This is a considerably better result than the art market's initial decline of 22%.

4.2.5 Market bubble

Table 14: NFT market Q1 2022 and Q2 2022[288]

Indicator	**Q1 2022**	**Q2 2022**	**Change (%)**
Volume of USD traded (million USD)	10.73	8.07	-25
Volume of sales (million)	12.64	10.11	-20
Buyers (million)	1.57	1.17	-25
Sellers (million)	0.90	0.58	-36
Active wallets (million)	1.86	1.25	-33

[282] Wang, et al., "Non-Fungible Token (NFT)," 14-15.
[283] Wang, et al., "Non-Fungible Token (NFT)," 14-15.
[284] McAndrew, *The Art Market 2022*, 48.
[285] Kong and Lin, "Alternative Investments in the Fintech Era," 5.
[286] Kong and Lin, "Alternative Investments in the Fintech Era," 5.
[287] Umar et al., "Covid-19 impact on NFTs and major asset classes interrelations: Insights from the wavelet coherence analysis," *Finance Research Letters* 47, no. 1 (2022): 5;
David Aharona and Ender Demir, "NFTs and asset class spillovers: Lessons from the period around the COVID-19 pandemic," *Finance Research Letters* 47, no. 1 (2022): 1.
[288] Nonfungible.com, *Quarterly NFT Market Report: Q2 2022*, 17.

Total profit at resell (million USD)	3.50	1.89	-46
Total loss at resell (million USD)	-1.16	-1.43	24
Average ownership duration (days)	31	48	55
Average price (USD)	849	798	-6

Source: data from NonFungible.com, *Quarterly NFT Market Report: Q2 2022* (Palmerston, Canada: NonFungible, 2022), 17.

The NFT market experienced substantial losses in the second quarter of 2022, with key indicators down between 20% and 46%.[289] Additionally, according to NonFungible.com, the volume of internet searches related to NFTs also dropped significantly.[290] This issue is compounded by freefalling cryptocurrency values. In November of 2021, the global crypto market capitalization was $2.9 trillion, and by November of 2022, it had fallen 71% to $852 billion.[291] Roose argues the market is "cooling off" with falling average transaction prices and occasional cancellations of auctions for high-value NFTs.[292] The level of market downfall, loss of enthusiasm, and loss of consumer confidence may indicate the beginning of a burst market bubble.

However, a receding market comes as no surprise given the state of the global economy. A plausible reason for the market's decline is the rising of interest rates by monetary authorities to combat economic downfall from Covid-19. Investors are less inclined to purchase high-risk alternative assets when interest rates are high. Analysis by NonFunfible.com highlights that general enthusiasm around NFTs has slowed, but is much higher than in early 2021, "we are in a rising tide phase. Even though the

[289] An example highlighting the market's downfall is the inability of the Jack Dorsey's tweet NFT, purchased for $2.9 million in March of 2021, to attract a bid over $14,000.
[290] *Quarterly NFT Market Report: Q2 2022,* 21.
[291] Christina Pazzanese, "After the 'Crypto Crash,' What's Next for Digital Currencies?," *Harvard Business School,* July 18, 2022, https://hbswk.hbs.edu/item/after-the-crypto-crash-whats-next-for-digital-currencies;
"Today's Cryptocurrency Prices by Market Cap," CoinMarketCap, accessed December 6, 2022, https://coinmarketcap.com/.
[292] Roose, "What are NFTs?"

current wave is receding, the tide level will still be higher than it was during the last wave."[293]

4.2.6 The FTX crash

In November of 2022, the world's second-largest cryptocurrency exchange 'FTX' filed for bankruptcy and sent the crypto market crashing.[294] On the 2nd of November, crypto media platform CoinDesk published an article revealing Alameda – a crypto hedge fund owned by FTX founder Sam Bankman-Fried – held billions in FTX's currency 'FTT.'[295] Alameda's trading on the FTX exchange meant they were in a position to benefit financially when other users lost money.[296] After this information was made public, FTT's price began declining as customers rushed to withdraw crypto assets, with $6 billion being taken out over 3 days.[297] Soon after, Bloomberg reported that the SEC and Commodity Futures Trading Commission were investigating FTX's use of client funds.[298] On November 10th, it was revealed that

[293] *Quarterly NFT Market Report: Q2 2022,* 21.
[294] Dan Milmo and Alex Hern, "What happened to FTX and could the crisis spill over to the rest of crypto?," *The Guardian,* November 10, 2022, https://www.theguardian.com/technology/2022/nov/10/what-happened-to-ftx-and-could-crisis-spill-over-to-rest-of-crypto.
[295] Ian Allison, "Divisions in Sam Bankman-Fried's Crypto Empire Blur on His Trading Titan Alameda's Balance Sheet," *CoinDesk*, November 9, 2022, https://www.coindesk.com/business/2022/11/02/divisions-in-sam-bankman-frieds-crypto-empire-blur-on-his-trading-titan-alamedas-balance-sheet/.
[296] David Yaffe-Bellany, "How Sam Bankman-Fried's Crypto Empire Collapsed," *The New York Times,* November 14, 2022, https://www.nytimes.com/2022/11/14/technology/ftx-sam-bankman-fried-crypto-bankruptcy.html.
[297] Milmo and Hern, "What happened to FTX."
[298] Lydia Beyoud, Yueqi Yang, and Olga Kharif, "Sam Bankman-Fried's FTX Empire Faces US Probe Into Client Funds, Lending," *Bloomberg*, November 9, 2022, https://www.bloomberg.com/news/articles/2022-11-09/us-probes-ftx-empire-over-handling-of-client-funds-and-lending#xj4y7vzkg.

Alameda had borrowed billions in FTX user funds for its investments, and owed FTX $10 billion.[299] Within days, FTX went from a $32 billion valuation to bankruptcy.[300]

Since, FTX has appointed new CEO John J. Ray, an American attorney and insolvency professional to handle the bankruptcy. Ray claims "never in my career have I seen such a complete failure of corporate controls and such a complete absence of trustworthy financial information."[301] Ray also finds that supervisors used corporate funds to purchase employees' homes and personal items, and Bankman-Fried encouraged employees to use auto-deleting messaging applications for communicating.[302] Furthermore, bank accounts and company financials were not tracked and software concealed the misuse of user's funds.[303]

The news of FTX's collapse caused volatility and a decline in cryptocurrency markets. In response to the news of FTX, Bitcoin dropped 14% and Tether sank below its peg price of $1 to $0.97.[304] Further, it was reported on November 9 that OpenSea's daily NFT trading volume fell from $7.1 million to $4.6 million in one

[299] Vicky Ge Huang, Alexander Osipovich, and Patricia Kowsmann, "FTX Tapped Into Customer Accounts to Fund Risky Bets, Setting Up Its Downfall," *The Wall Street Journal*, November 11, 2022, https://www.wsj.com/articles/ftx-tapped-into-customer-accounts-to-fund-risky-bets-setting-up-its-downfall-11668093732?mod=hp_lead_pos1.
[300] MacKenzie Sigalos, "Sam Bankman-Fried steps down as FTX CEO as his crypto exchange files for bankruptcy," *CNBC*, November 11, 2022, https://www.cnbc.com/2022/11/11/sam-bankman-frieds-cryptocurrency-exchange-ftx-files-for-bankruptcy.html.
[301] *Declaration of John J. Ray III in Support of Chapter 11 Petitions and First Day Pleadings 2022,* 22-11068 (JTD), 2, (2022), statement of John J. Ray, Chief Executive Officer, FTX Trading LTD), https://pacer-documents.s3.amazonaws.com/33/188450/042020648197.pdf.
[302] *Declaration of John J. Ray III in Support of Chapter 11 Petitions and First Day Pleadings 2022,* 22-11068 (JTD), 25, (2022), statement of John J. Ray, Chief Executive Officer, FTX Trading LTD), https://pacer-documents.s3.amazonaws.com/33/188450/042020648197.pdf.
[303] *Declaration of John J. Ray III in Support of Chapter 11 Petitions and First Day Pleadings 2022,* 22-11068 (JTD), 23, (2022), statement of John J. Ray, Chief Executive Officer, FTX Trading LTD), https://pacer-documents.s3.amazonaws.com/33/188450/042020648197.pdf.
[304] Louis Ashworth and Bryce Elder, "Watching tether wither, together," *Financial Times,* November 10, 2022, https://www.ft.com/content/86ff86f9-a0b1-448f-af11-b8dd9ae8577d;
Joshua Oliver, Scott Chipolina and Nikou Asgari, "Sam Bankman-Fried's $32bn FTX crypto empire files for bankruptcy," *Financial Times*, November 11, 2022, https://www.ft.com/content/afe56c4e-2d68-457e-bbb2-476752d5f02e.

day.[305] Solana's daily trading volume declined from $70,000 to $14,000.[306] These figures highlight the NFT market's sensitivity to cryptocurrency volatility. The FTX collapse is predicted to lead to increased regulation of the crypto world.[307]

4.2.7 The future of the NFT market

a. Drivers for market growth

The NFT market is embryonic and has significant room for growth. Much of this growth will come from the improvement of regulation in NFT marketplaces. The transparency of blockchain is conducive to platforms seeking to improve security measures, including the discovery of malicious or illegal activity.[308] Greater self-regulation, banning users, and applying penalties may limit risks.[309] Platforms are already implementing strategies to monitor and detect infringements, such as the NFT platform DeviantArt, which in 2021 launched image recognition software that scans blockchains for potential art and NFT infringements.[310] Additionally, as the NFT market grows in size and depth, regulation will likely increase.[311]

Offering another perspective, NFT Factory co-founder John Karp claims the biggest barrier to the market's growth is psychological, "depending on your mentality, your aversion to innovation … it will take more or less time for you to take an interest in it … the faster we communicate and communicate strongly, the closer we get to

[305] Cam Thompson, "FTX and Alameda Contagion Fears Tank NFT Markets," *CoinDesk,* November 9, 2022, https://www.coindesk.com/web3/2022/11/09/ftx-and-alameda-contagion-fears-tank-nft-markets/.
[306] Thompson, ""FTX and Alameda Contagion Fears."
[307] Billy Bambrough, "'Dot-Com Era on Steroids'—Here's How Bad The $2.2 Trillion Bitcoin And Crypto FTX Price Crash Could Get," *Forbes,* November 23, 2022, https://www.forbes.com/sites/billybambrough/2022/11/23/dot-com-era-on-steroids-heres-how-bad-the-22-trillion-bitcoin-and-crypto-ftx-price-crash-could-get/?sh=5a9586a85cc8.
[308] McAndrew, *The Art Market 2022*, 48.
[309] McAndrew, *The Art Market 2022*, 48.
[310] McAndrew, *The Art Market 2022*, 47-48.
[311] McAndrew, *The Art Market 2022*, 48.

this snowball that will allow adoption."[312] Karp believes by 2028, "the same way as the internet which is everywhere, NFTs will be everywhere."[313]

b. Market outlook

The NFT market may stabilize. Blockchain economist at Chainalysis, Ethan McMahon, believes the market is adjusting to an inflationary period caused by extreme hype around popular collectible NFTs such as Bored Ape Yacht Club.[314] A stabilized market will theoretically reduce the market's level of risk and encourage greater participation. Alternatively, NFT proponents – such as Anjum Malik, co-founder of crypto hedge fund Manhattan Crypto Capital – liken this decline period to any other economic cycle, claiming it's "just a cycle, just like in real estate."[315] Malik believes in "buy[ing] the dip. It's just revitalization."[316]

Another possible scenario is that NFTs become important assets as metaverses become increasingly relevant and legitimized in the real world. A metaverse is a shared virtual world that attempts to recreate a digital version of reality.[317] One example is Decentraland, where users can participate by purchasing NFT avatars, avatar wearables, plots of land, and real estate.[318] Recently, large companies have shown interest in metaverses, including Facebook which has expressed intent to become a metaverse that will incorporate NFTs.[319] In relation to the artworld, Sotheby's has purchased a plot on Decentraland where it has built a replica of its London gallery.[320] In June of 2021 Sotheby's held its first Decentraland gallery

[312] *Quarterly NFT Market Report: Q2 2022,* 35.
[313] *Quarterly NFT Market Report: Q2 2022,* 35-36.
[314] Lara Williams, "The NFT market has collapsed (but that may not be a bad thing)," *Investment Monitor,* August 21, 2022, https://www.investmentmonitor.ai/crypto/nft-market-collapse-cryptocurrency-value.
[315] Williams, "The NFT market has collapsed (but that may not be a bad thing)."
[316] Williams, "The NFT market has collapsed (but that may not be a bad thing)."
[317] Matthew Sparkes, "What is a metaverse," *New Scientist* 251, no. 3348 (2021): 18.
[318] Decentraland, "Welcome to Decentraland," accessed November 8, 2022, https://decentraland.org/.
[319] Sparkes, "What is a metaverse," 18.
[320] Sparkes, "What is a metaverse," 18.

auction, realizing revenues of over $17 million.[321] As metaverses become increasingly common, NFT art and collectibles will likely attract greater investment.

[321] Partner content, "NFTs: the tokens that could change our world," Financial Times, accessed November 8, 2022, https://www.ft.com/partnercontent/crypto-com/nfts-tokens-that-could-change-our-world.html.

5 Conclusion

This paper recommends art investment funds consider the investment of NFTs as an alternative to, or in addition to, traditional art assets. Most art investment funds have not overcome issues related to the fine art market's inefficiencies. The market's high level of information asymmetry, opacity, illiquidity, and exorbitant friction costs have prevented fine art from becoming a legitimate investment tool and discouraged investors from participating in art investment funds, including Chase Art Fund, Fernwood, Art Trading Fund, Meridian Art Partners, and Dean Art Investments (to name a few).[322]

It can be concluded NFT investment is a more viable option than fine art investment for art investment funds. In theory, the NFT market operates at a significantly greater level of efficiency than the art market. The NFT market's blockchain technology enables transparency and stronger transactional analysis of NFTs for art investment funds. Additionally, the NFT market is not seasonal, is available 24/7, and is markedly more liquid than the art market. Ownership and authenticity of an NFT can be instantly proven and transferred and does not require an intermediary, whilst trading fine art can take three to six months. The NFT market's low gas and platform fees (approximately 0.2% to 2% respectively) make this asset considerably more attractive than fine art (fees for trading art can range from 25% to 50%). Additionally, whilst there are significant limitations to technical analysis of heterogeneous goods and an illiquid market's risk-return profile, NFT art and collectibles markets outperform conventional investment markets in all studies analyzed, whilst the painting market did not.[323] However, relative to traditional assets,

[322] Maneker, "Art Funds: Who's Left Standing?"
[323] Throughout this thesis, comparison of the returns and standard deviations of the NFT and traditional painting markets should not be used to conclude which asset is more appropriate.

NFTs are found to be a considerably high-risk investment. Whilst other investment characteristics of fine art and NFTs addressed in this study are important for art investment funds to assess, the markets' level of efficiency is likely to be most consequential for raising capital and performance.

It is important for art investment funds to understand the risks associated with the NFT market's unregulated practices and security issues. Customers are not audited on a 'know your customer' basis, and NFT owners are at risk of copyright infringements, spoofing, tampering, and wash trading. Additionally, the NFT market is highly sensitive to crypto market volatility, evident in the recent crash of FTX.

Therefore, there is considerable room for improvement in the NFT market. As the market matures, and applications of cryptocurrency, NFTs, and metaverses become more commonplace, it is likely the industry's regulation and security measures will improve and the market will stabilize. This will enable further market growth, and therefore improve market liquidity.

This thesis has endeavored to constitute a preliminary discussion of NFT art and collectibles investment by art investment funds. It is hoped that the findings and analysis in this study will inform further discourse on solutions to the issues faced by the art investment fund industry. In doing so, this thesis aims to contribute to the artworld's democratization.

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