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NFT Art, an Investment Alternative for Everyone?

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Abstract

Investing, in general, was costly and only accessible to a few people in the past century. Enhanced by the ensemble between art and stock market prices, growing wealth was mostly a privilege for the wealthy. Now, in the era of decentralization and NFTs, investing in art is possible for everyone connected to the internet. This work analyses if investing in affordable NFT art had been profitable in the past. Comparing the results with traditional art investing on a quantitative and qualitative aspect, ... SHARPE RATIO, STOCKS IMPACT, ACCESSIBILITY, PRESTIGE

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1 Introduction

- Motivation Ihrer Forschungsfrage, Begründung und Relevanz Ihres Themas

Alternative investments like art are not common among the broad population. Or at least they used to be uncommon. With the evolution of the blockchain technology and smart contracts, a new way of ownership is on its way to the public. Non-Fungible Token (NFT) are on the raise to disrupt the way how people can invest and trade alternative investments like art.

Art used to be an investment alternative only for the wealthy. Auctions were only accessible for selected people. Especially if the costs of getting to the auction is already exceeding potential profits out of the plain investment in the art.

Investing in NFT art makes it possible to invest in a unique piece of art and the only thing you need to participate in the auction is a WiFi connection.

Of course art is more than just an investment object. This makes it almost impossible to predict future art prices. But before we look into the future of NFT art as an investment alternative, we can try to understand the past.

- Welche Lesergruppe möchten Sie erreichen?

This work is meant for everybody who is interested in alternative investments, especially art. private investors, wealthy and not so wealthy (only a few dollars left per month for investing)

- Kurzer Überblick über die Struktur der Hausarbeit

First we give a brief introduction into the blockchain technology in general. Then we will define what an NFT is and important coherent key words.

Next, we take a look into traditional art investing, to be able to compare investing in NFT art with how this kind of alternative investing used to look like.

The main part consists of analysing a big data set of NFT trades. We look at the top 100 NFT art collections on of the biggest NFT platforms when it comes to trading volume. The analysis mainly focuses on the achieved profit from the first purchase to the next sale. We will not try to predict future NFT prices. Instead, we check for anomalies in the profits in terms of the initial NFT price and the holding period, the

time between the first and second trade of the NFT.

- 366 Words

2 Literature Review

- Systematische Darstellung der verfügbaren Literatur zu einer bestimmten Forschungsfrage
- Was wurde schon bewiesen, problematisieren oder widerlegen?
- Leitende Forschungsfrage: Was möchten Sie darlegen, beweisen, problematisieren oder widerlegen?

2.1 Understanding NFTs

2.1.1 Blockchain

A blockchain is an ever-growing list - specifically, an ordered sequence of messages maintained by a network of servers. There are many different blockchains in use today. The most popular are Bitcoin and Ethereum: As one measure of their popularity, their combined market value exceeds \$1Trn at the time of writing. The mechanics underlying blockchains can be quite complicated, and are out of scope for this paper. To understand what they do, however, doesn't require much understanding of how they work. Instead, it is helpful to conceptualize a blockchain as a kind of digital bulletin board that contains a sequence of messages with a few special properties:

1. Append-only posting: Messages, once posted, cannot be removed.
2. Immutability: Messages, once posted, cannot be modified, nor can their ordering.
3. World readability: Anyone can view the full contents of the blockchain, i.e., all messages.

These simple properties enable surprisingly powerful functionality. For example, transfers of NFT ownership on a given blockchain are publicly visible (thanks to their world-readability). They remain so for as long as the blockchain exists and are irrevocable (thanks to immutability and append-only posting).

2.1.2 Token

2.1.3 Non-fungible vs Fungible Token

ERC-20

ERC-721

Why are ERC-721 not being used as a currency?

2.1.4 Minting

The creation of an NFT is a process known as minting. To mint an NFT, a user—or platform acting on behalf of the user—calls a special function in the smart contract where the NFT will reside. (Some marketplaces have a form of “lazy” minting in which an NFT is minted on the blockchain only when it is first sold or transferred.)

2.1.5 NFT Art

An NFT for an artwork consists of a digital pointer that is publicly and permanently recorded on a digital ledger - specifically on a blockchain. This pointer is an address for the content of the NFT, which usually but not always resides off chain, meaning in a system separate from the blockchain, e.g., a cloud server or a so-called decentralized storage system such as IPFS [31, 107].² (An NFT may also include a pointer to metadata, e.g., the token name and description.) Recorded in association with an NFT is an account identifier corresponding to its owner. These account identi

ers are (randomized) numerical values, not real-world names, so NFT ownership is pseudonymous by default. Ownership can change, of course: NFTs can be bought and sold or simply transferred to new owners, and thus moved to new accounts. To understand how NFTs work, it’s important to be familiar with a few key concepts that we now briefly describe: wallets, private keys, minting, and marketplaces. In the next couple of subsections, we provide a little more technical detail on the systems that enable NFTs.

2.1.6 Wallets

Wallets: Because an NFT resides on a blockchain, users must employ blockchain-specific software known as a wallet to buy, sell, create, and maintain possession of NFTs. Wallet software runs on a user device such as a mobile phone or a laptop

and provides a graphical interface through which users can perform NFT-related transactions. As the term wallet suggests, wallets also allow users to obtain and transact in cryptocurrency. Use of cryptocurrency is a requirement for NFT buyers and sellers, as NFTs are usually bought and sold using the cryptocurrency native to the blockchains on which they reside.

2.1.7 Marketplaces

NFTs for sale can be listed on marketplaces, websites that act as front ends for the blockchains on which the NFTs reside. Marketplaces can be viewed in an ordinary browser (even without use of a wallet). In addition to advertising NFTs and intermediating the sale of NFTs, marketplaces also provide technical tools for the creation of NFT smart contracts. In return, they collect commissions on the NFT sales they intermediate. As an example, one of the largest NFT markets today is OpenSea [37]. OpenSea NFTs reside on the Ethereum blockchain, and NFT prices on OpenSea are therefore quoted in Ether (ETH), the native cryptocurrency of Ethereum. (At the time of writing, 1 ETH is worth about \$3000, but prices are extremely volatile.) To create, buy, or sell NFTs, most users interact with OpenSea using a wallet known as Metamask, which is available as a browser plug-in.

Execution within seconds

2.1.8 NFT Boom

The year of 2020 marked the beginning of mainstream artists publishing their work in the form of NFTs. The sale of 10 NFTs for \$6 million in December of 2020 by the Canadian musician Grimes was a landmark event in the music community [143]. By early 2021, Rolling Stone declared that music NFTs had gone mainstream, noting that Kings of Leon became the first band to release a new album as a non-fungible token (NFT) in March 2021—with great success [124]. In summer 2021, prominent traditional artist Damien Hirst [8] announced the sale of a series of 10,000 hand-painted dot-covered works on paper entitled *The Currency*. He gave buyers the option of receiving the physical work or having it destroyed and represented as an NFT. Well-known auction houses such as Sotheby’s [70], Christie’s [54], Phillips [109], and others also started to conduct NFT sales [139] as NFTs caught the eye of influential artists. One prominent example of the burgeoning acceptance of NFTs in the art community was the \$69 million sale by Christie’s of the NFT art piece “Everydays” [67, 135] by digital artist Mike Winkelmann [48] (artist name Beeple). This sale propelled NFTs into the media spotlight and Beeple to fame outside the cryptocurrency-art circles in which he was previously known. In the next section,

Section 5, we examine the most recent past year of NFT history, and discuss the current shape of the NFT ecosystem.

2.1.9 NFT Market Today

Just as technology development for cryptocurrencies is advancing at a breakneck pace, so too are technologies and fads in the world of NFTs. A description of what purports to be the current state of the NFT ecosystem would no longer be current after a few months. Therefore we instead offer a snapshot of the NFT landscape in early 2022, spotlighting what we view as the most significant emerging and popular forms of NFTs, with an emphasis on art and collectables. We organize this snapshot of the state of the NFT industry into three separate pillars: Section 5.1 deals with who the market participants are, Section 5.2 considers what types of NFTs they interact with, and Section 5.3 discusses the places where these market participants interact.

2.1.10 The Bot Art Market

A future is conceivable in which machines shape or even dictate tastes in art markets. Machine learning can be used to create NFT artwork and also to purchase it. Thus the principles of taste that govern the desirability of NFTs may deviate from human taste. While this seems to be a futurist prediction, machine learning is already used to generate NFT artwork. For instance, an algorithm called Botto generates art and each week mints a piece as an NFT based on votes from the Botto community [15]. The Gan Apes [30], a series of NFT artworks, are created by feeding existing NFT artworks called the Bored Apes into a machine learning system called a Generative Adversarial Network (GAN). What is created is an image generally recognizable as a version of a Bored Ape, but differing in form, color, and style. Machine learning has another role to play in NFT markets as well. NFTs more closely resemble traditional financial instruments than traditional works of fine arts, as discussed in Section 6.2. Financial trading firms commonly use machine learning to craft trading strategies. NFT trading is a natural application of machine learning algorithms, one that will inevitably arise if it hasn't already. An interesting twist, however, is that such algorithms may take as input not just data on market dynamics, but also characterization of the style of NFTs, i.e., trade in part based on NFT styles. Beyond prediction of NFT market movements to devise profitable strategies, machine learning algorithms could also discover ways to manipulating art markets, i.e., strategies to influence the trading behavior of market participants. The result would be use of machine learning algorithms not just to predict market movements, but to influence them for profit.

2.2 Traditional Art Investing

Art Market

Traditional art is typically traded either at auction or from a dealer. One of the major auction houses is Christies.

Market Participants

There are three sources of demand: dealers, museums, and private collectors.

2.2.1 Traditional Art as an Investment

First studies like Anderson [1] from 1974, have examined paintings as an investment over the period from 1780 to 1970. Their results show that art investments on the one hand can provide positive annual return. But on the other hand compared with other investment alternatives, the risk-adjusted return is less attractive.

Compared to NFTs, which are traded on a blockchain that stores all the owner and price history of the individual asset, traditional art profits can not easily be calculated by comparing the purchase and sale of the asset. I.e.

Π = Profit

p_0 = Asset price at time 0 (initial purchase)

p_1 = Asset price at time 1 (sale after first purchase)

$$\Pi = \frac{p_1}{p_0} - 1$$

As a consequence, the profitability in literature on investments in traditional art, was quantified by setting up an index of art prices.

Anderson [1] first approximated that following the mean variance approach to portfolio theory the total return must be similar to another equally risky asset. The risk is estimated by applying the Central Limit Theorem on the variance in annual returns of the constructed price indices.

Anderson [1] came to the conclusion, that the price of a painting depends on the reputation of the artist, the year it was sold and the size of the painting. Risk return ratios of paintings can be compared with those of common stocks. Lower risk return ratios may be due to the consumption value of the art.

This is of course not 100% accurate since it is possible that only art prices on the primary market go up, but investors can not sell their art on the secondary market, or at least not for a profit. This makes the whole comparability of traditional art with the NFT art market less significant. The analysis in this work will therefore

also include traditional asset classes like a bond and stock market index.

2.2.2 Art and Money

Further studies like "Art and Money" from Goetzmann, Renneboog, and Spaenjers [2] were still using a similar approach in 2009, like the from Anderson [1]. Goetzmann, Renneboog, and Spaenjers [2] investigated the impact of equity markets and top incomes on art prices. They constructed an art index and tested for correlation between the art index, the stock market and wealth of the wealthy. The wealth data used for their analysis rely on income tax data of the top 0.1% income share. Their results "strongly" suggest the existence of a long-term relation between top incomes and art prices. In other words, "it is indeed the wealth of the wealthy that drives art prices".

2.2.3 Buying Beauty: On Prices and Returns in the Art Market

Renneboog and Spaenjers [4] have studied the investment performance of traditional art with a more recent and larger data set than previous work has done.

Data set ranges from 1957 to 2007

2.2.4 Does it Pay to Invest in Art? A Selection-Corrected Returns Perspective

2.2.5 Alternative Investments in the Fintech Era: The Risk and Return of Non-fungible Token (NFT)

NFTs have higher returns than traditional financial assets but also higher volatility, resulting in a comparable sharpe ratio to the NASDAQ index. NFT prices depend on tokens scarceness (Knappheit) and investor's aesthetic preference.

What are alternative investments: real estate, fine arts, wine and collectible stamps
Used for diversifying portfolios from traditional investments such as stocks, bonds mutual funds etc.

NFT interesting exploding since 2021

Literature on this crypto innovation as an alternative investment class is rather limited.

NFTs are used for proving ownership

In this paper CryptoPunks Collection is used to construct an NFT index, data since

2017

Time period for the crypto market too short.

Unlike this paper states cryptopunks "epitomize" the NFT market, we assume that other more affordable collections should be considered.

2.3 A Digression on Wealth

This be able to answer the question of this work, if NFT art is an alternative investment for everyone, we must know something about the individual financial ability to invest in alternative products. Not everybody is able to investment millions for one NFT. In order to find some Investment boundaries we take a look at the Capgemini World Wealth Report 2022.

The report states directly: "NFTs are cryptographic assets on a blockchain with unique identification codes and metadata that distinguish them from each other. They cannot be traded or exchanged at equivalency.

Amundi, Europe's largest asset manager announced in early 2022 that it would launch NFT products allowing clients to invest in companies operating in this space or directly in NFTs. [Fnlonon, "Amundi sets sights on booming NFT market;" February 16, 2022]

Wave Financial and Criptonite Asset Mangament have launched NFT fund for qualified investors in Switzerland. The fund features NFT collectibles, platforms, and protocols, with around 70% of allocations to the thriving digital art and collectibles space." [Hedgeweek, "Wave Financial and Criptonite Asset Management launch NFT fund for qualified investors in Switzerland;" March 28 2022]

2.4 Alternative Investment: NFT Art

NFT artwork can be treated as digital wealth, much like cryptocurrency, in that it can be valuable and quickly transferable irrespective of buyer and seller geographies. These features have already led to the use of NFT artworks as collateral for loans [35], financial derivatives [11], and NFT artwork price prediction markets [116]. As a valuable asset, NFT artwork will also spur the growth of related industries, like insurance companies with the technological knowledge to offer NFT artwork insurance for theft or loss and NFT artwork experts to advise wealthy buyers.

Fine Art		Art Blocks, Organic Growth Crystal Reef, Brotchain, Fidenza, Damien Hirst’s Currency
Profile Picture Collections		CryptoPunks, Bored Ape Yacht
Collectibles		Club Parallel Cards, NBA Top Shot
Crowdfunding Production	Media	Treeverse, ETH-MEN, Shibuya
Grassroots Building	Community	Loot, n project
Fractional Ownership		Fractional.art, SharkDAO, Founders DAO
Identity Tokens		Proof of Humanity (PoH), Proof of Attendance Protocol (PoAP)

Table 1 Taxonomy of popular NFTs

2.4.1 Categories

2.4.2 NFTs as a Crowdfunding Mechanism

NFTs as a Crowdfunding Mechanism: Many projects in the NFT ecosystem use the sales of collections of art NFTs as a means of selling the intellectual property rights to a character or participant in a soon-to-be-developed media collection (like a comic, movie, television show or game). The proceeds then bankroll further development of the media project, in a manner akin to crowdfunding sites like Kickstarter or GoFundMe. In the existing ecosystem, these NFT projects tend to focus on building ecosystems of intellectual property, stories and artwork associated with the NFT collection, slowly growing an entire media franchise centered around the NFTs. Examples of this kind of crowdfunding NFT in gaming include Treeverse [105] and Colony Online [56], both of which sold NFTs to raise money for development of Massively Multiplayer Online Role Playing Game (MMORPG)-style video games. For example, Treeverse sold NFTs that were meant to be used in the upcoming game as private homes for owners of plots of land. In Colony Online’s case, the NFTs represent animal characters meant to be used as the sprite, that is, the avatar, of the owner while interacting in the game-world. Comic-startup companies have also used NFTs as a means to bootstrap a project: Both PixelVault PUNKS Comics [90] and ETH-MEN [65] sell NFTs for tokenized comic books such that access to read the comic is restricted to people that have purchased the token. The PUNKS Comics project uses NFTs in a novel way. That project promises that in the future, a physical comic book they create will be mailed only to people who participate in a “burning” event in which users render their tokens unusable by transferring them to a special address that no one controls [90]. NFTs have also bled into video media. For example, the Forgotten Runes Wizards Cult [72] project used proceeds from the sale of a

group of 10,000 wizard-picture NFTs to fund a partnership with the animation studio Titmouse to produce an animated television show about the lives of the wizards in the NFT collection itself [6]. The Shibuya.xyz project [98] is producing an Anime television show. The team behind the project sells “episode” NFTs on a regular basis that allow the person who purchases the NFT to vote on the trajectory that the episode will take, similar to the decision points in a choose-your-own-adventure game [99].

2.5 Investment Alternative for Everyone?

2.5.1 Market Participants

Creators (Artists and Developers)

Artists and smart contract developers create the art and infrastructure that support the NFT ecosystem. Many of them come to acquire NFTs, not infrequently as gifts from friends or fellow artists. As such, they constitute a special class of collectors and tastemakers. While there have been examples of famous artists who were or are also collectors (e.g., Damien Hirst [8]), the ease with which relationships can be formed and NFTs can be transferred has made interactions among creators especially vibrant within the NFT community. For instance, creators will partner to host digital events. Creators in the traditional art world have held co-hosted events as well, but the speed and geo-diversity of Internet culture means artists can hold digital events more often and more easily than events at a gallery. For example, the prominent cryptoartist Farokh [68] holds weekly podcasts with other NFT artists, which are accessible to anyone with an internet connection, in contrast to the exclusive events held by traditional galleries in the physical world [95, 96]. Another prominent NFT artist, FVCKRender [76] is well known in the community for being an avid collector as well as artist. His OpenSea profile, for example, shows that he owns over 1500 NFTs created by other artists [75].

2.5.2 Real-World Interaction Tokens and Identity Tokens

One last NFT collectable trend in the current ecosystem are identity tokens that serve as both as collectibles and as tokens that prove some sort of fact about a human being. One example of this is the Proof of Attendance Protocol (PoAP) ecosystem [91]. PoAP NFT tokens are intended to be given out by organizers at conferences as conference swag, like stickers or tee shirts. Often these tokens will have a corresponding piece of art for that year’s conference attached to the token. Later, anyone can verify ownership of a PoAP token, and view the list of tokens for

attendance to each unique event. These tokens can then be used by groups that want to only interact with people that attended certain conferences or real-world events. PoAP tokens are subvertible, in the sense that cheating conference organizers can distribute fake credentials. For higher quality identity NFTs, the Proof of Humanity (PoH) [92] project grants NFT tokens to Ethereum users who prove they’re a human. The PoH system requires submitting video evidence answering a list of questions, and it also utilizes a system in which people must have other people “vouch” for their humanness and the uniqueness of their asserted identity. Today, identity NFTs are not widely used. Their use has been limited to gating access to NFT-related parties or to opportunities to purchase new NFTs [53, 142]. We believe, however, that identity NFTs will assume a much larger role in the NFT ecosystem in the future. We discuss this idea in Section 6.

2.5.3 NFT Communities

Some discussion and interaction among NFT market participants occurs on sites like Instagram, Facebook, and Tik-Tok, but the majority happens on two social media networks: Twitter and the Discord chat application. Typically an NFT community will create a Discord server (a chat server) for community members, with gated chat channels only accessible to members that have proven ownership of an NFT in the associated collection. The largest of these communities tend to include tens of thousands of users. For example, as of March 2022, the Bored Ape Yacht Club has 148,000 Discord users, and the Larva Labs (the company behind CryptoPunks, Autoglyphs, and Meebits) Discord has 56,000 registered users. Twitter too serves as a platform for discussions among influencers, thought leaders, and regular users. Commentary on Twitter is more public than Discord, since all Tweets are fed into one central timeline, as opposed to the segmented chat servers of Discord. Unlike the case in many industries, in the NFT space many influencers on Twitter have dedicated pseudonymous accounts that discuss only NFTs and display expensive collections. Examples include Cozomo de Medici (confirmed to be the famous rapper musician Snoop Dogg), who as of March 2022 has 214.3K followers [57] and Punk 6259 who has 285.4K followers [40]. Traditional “influencers” also take part: Artists and celebrities such as Steve Aoki [44], Logan Paul [32], and DeadMau5 [24] partner with different NFT collections, promote them on Twitter, and even release their own NFTs. Twitter has embraced the NFT community, even offering a feature in its paid Twitter Blue subscription service that allows users to distinguish their NFTs as their profile pictures with hexagonal portraits, as opposed to the usual circular portraits of non-NFT users. The service validates that the NFTs are actually stored on-chain,

but does not limit which NFT collections are allowed to be used or validate that the NFT collection itself is legitimate or fake in any way.

Investors

Another category of NFT buyer is those who seek to earn a profit over the long term based on astute anticipation of the NFT community’s evolving tastes and market dynamics. Some of these investors, both individuals and institutional investors, resemble those in traditional art markets, as discussed in Section 3. Examples of the latter include Three Arrows Capital [103, 104]. They are known for collecting computer generated digital art pieces from a well-known curated online NFT Art gallery called Art Blocks [49] and describe themselves as “a hedge fund established in 2012 and focused on providing superior risk-adjusted returns.” Smart contracts, however, have also given rise to NFT investors for whom counterparts in the traditional art world are rare or non-existent. For example, many NFT investors invest in fractional ownership or shares of high-value works of art, a relatively unpopular practice in traditional art markets. For example, fractional.art [73] allows any owner to fractionalize her or his NFT in a smart contract vault, which issues partial shares of the NFT that can then be traded and sold. This practice allows investors to gain exposure to NFTs they could not afford to own in their entirety. Some investors invest in NFTs by way of Decentralized Autonomous Organizations (DAOs), smart contracts that realize institutional investment with governance rules enforced by code. For example, members of SharkDAO [97] use a DAO to fractionalize Nouns [86], an expensive variety of NFT. There are many similar DAOs for other high-value NFTs, e.g., CryptoPunks, Bored Apes, etc. (See Section 5.2 for further discussion of DAOs for NFTs.)

Flippers

The last category of participant in the NFT ecosystem are flippers: a special class of investor who hold NFTs for very short periods of time. As discussed in Section 3, flipping is frowned upon and discouraged in traditional art markets. In NFT markets, it is a common practice, however (although it can be and sometimes is prevented by having smart contracts enforce minimum holding periods on NFTs). Many NFT flippers exhibit behaviors like those of arbitrageurs in traditional financial markets: They employ technically sophisticated strategies to exploit arbitrage opportunities between different marketplace platforms, gain priority access to NFTs before the general public to sell at a higher price (frontrunning [115]), and so forth. Indeed, some prominent arbitrageurs such as MEVCollector [81, 82] and SneakyNinjaPants

[100, 101] publicly discuss and arbitrage both cryptocurrency and NFT transactions in search of profit.

2.6 Measuring Profitability

Top profits driving traditional art prices already indicate a restriction for people having an yearly investment budget of less than, for example, \$1000.

2.6.1 Who Should Buy and Own NFTs?

The ability to create, buy, and trade NFTs at present is more open than in traditional art markets. NFT artists must only have access to a cryptocurrency wallet application, make an account on a platform like OpenSea, and be able to pay transaction fees to mint their NFTs. NFT buyers have the same technical requirements. Although access to traditional fine art markets is limited by gallerists and auction houses, which often exclude unknown buyers or those with a reputation for reselling works, the traditional art market is still notorious for money laundering [117]. Without gate-keeping by gallerists and auction houses, anyone with the resources can participate in the NFT market. This openness could lead to a more democratized art market, however, it raises regulatory concerns. Identity verification standards to purchase and trade NFTs are not universally enforced. In the broader cryptocurrency ecosystem, identity verification and enforcement against money laundering and the financing of terrorism has been left to exchanges, the companies that allow trading of cryptocurrency for government-issued currencies and vice versa. With identity verification completed as a separate step at the discretion of private companies for many cryptocurrency-to-cryptocurrency transactions, legal enforcement against criminal users can be challenging. As NFTs embody large amounts of value, their use for illicit purposes as an alternate form of digital wealth to cryptocurrency will raise challenges for national financial law enforcement agencies. One potential solution would be to require identity verification using a centralized or decentralized identity system before an individual can interact with NFT trading platforms. As with know-your-customer (KYC) / anti-money-laundering (AML) systems in the traditional financial system, sanctions lists could arise for users who have engaged in criminal activity.

2.6.2 New Financial Instruments with NFT Artworks

An NFT artwork can be easily fractionalized and owned by groups of collectors using a smart contract that custodies the work and parcels out ownership shares. These

ownership shares can be publicly viewed, ownership can be proven, and shares can be resold or further fractionalized. Buyers of NFTs have in some cases achieved massive and rapid price appreciation by fractionalizing ownership and selling shares. (Their approach is analogous to real estate developers who buy parcels of land and carve them into lots.) For example, DOGE, an NFT of an image of a dog, sold for a total of 11,000 ETH once fractionalized after its initial purchase for 1,696.9 ETH [137]. Protection against fractionalization using price caps by artists hoping to discourage price speculation for their work can be found in Section 6.1. Art funds in traditional markets have not become popular. In contrast, there has been a significant growth of funds where investors buy re-sellable shares of a selection of NFTs from successful collections. These funds are roughly like index funds, allowing investment in a portfolio of NFT artwork that is broadly representative of a segment of the NFT market. While the reason for the popularity of such funds in the NFT community is unclear, it no doubt helps that NFT artworks can be bought and sold quickly, without the hassle of transporting and securing valuable physical objects. NFT funds typically operate in a decentralized manner as DAOs (see Section 5.2). DAOs enable funds with no managers, only stakeholders, and could revolutionize collective ownership of fine art [14]. Similarly, one could imagine NFT art museums operating as DAOs, with patrons guiding acquisitions and exhibitions.

3 Data

4 Analysis

Analysed top 100 NFT art collections (Top 100 Opensea.io ranking from 1st October 2022, 11:00 am CET).

From top 100, searched for all trades since 1.1.2019 on Etherscan.io. Download max. daily 1000 trades of each collection until 3.10.2022

Collected 300k NFTs out of these collections. Analysed 600k trades from etherscan.io (3rd and 4th of October 2022). First trade made on Opensea + second trade in order to calculate a profit:

$$profit = buy_{price} / sell_{price} - 1$$

Looking at the distribution of when the NFTs of each collection were sold the first time, the most sales happen on the first days and flatten from time to time. This suggests that each collection has its own hype.

Cluster NFT Prices with scikit learn to 3 Groups. Expensive, medium, cheap and calculate average return of each NFT price segment.

Days between first and second trade of each NFT

4.1 Data Gathering

Potential selection issues with the data. Only Opensea.io trades and selected Collections come from the top 100 art collections on opensea.io being ranked on beginning of October 2022. Compared to traditional art price indices, there can't be survivorship bias in the art market. Since all trades, even those with a total loss, are included on the blockchain..... resale, Goetzmann (1996) shows that survivorship issues can put a significant upward bias on estimated returns. Goetzmann, Renneboog, and Spaenjers [2]: It is a more pressing issue when solely focusing on the performance of art as an investment.)

hedonic approach for analysing returns?

To get an estimate of the index over T periods based on N repeated sales observations, we follow the Bayes formulation of a repeat sales regression, which imposes some additional restrictions on the estimation, outlined in Goetzmann (1992, 1993):

where X again is a $N \times T$ matrix of dummy variables indicating the holding period for each object, the weights w are the times between sales, and R is the N -dimensional vector of logged returns. Additionally, J is a matrix of ones, and σ^2 is a constant that divides the variance of the residual error by the variance of the index:

The Bayes formulation avoids spurious negative autocorrelation in the estimated return series, and leads to a much more accurate estimator when the number of observations is relatively small (Goetzmann, 1992).

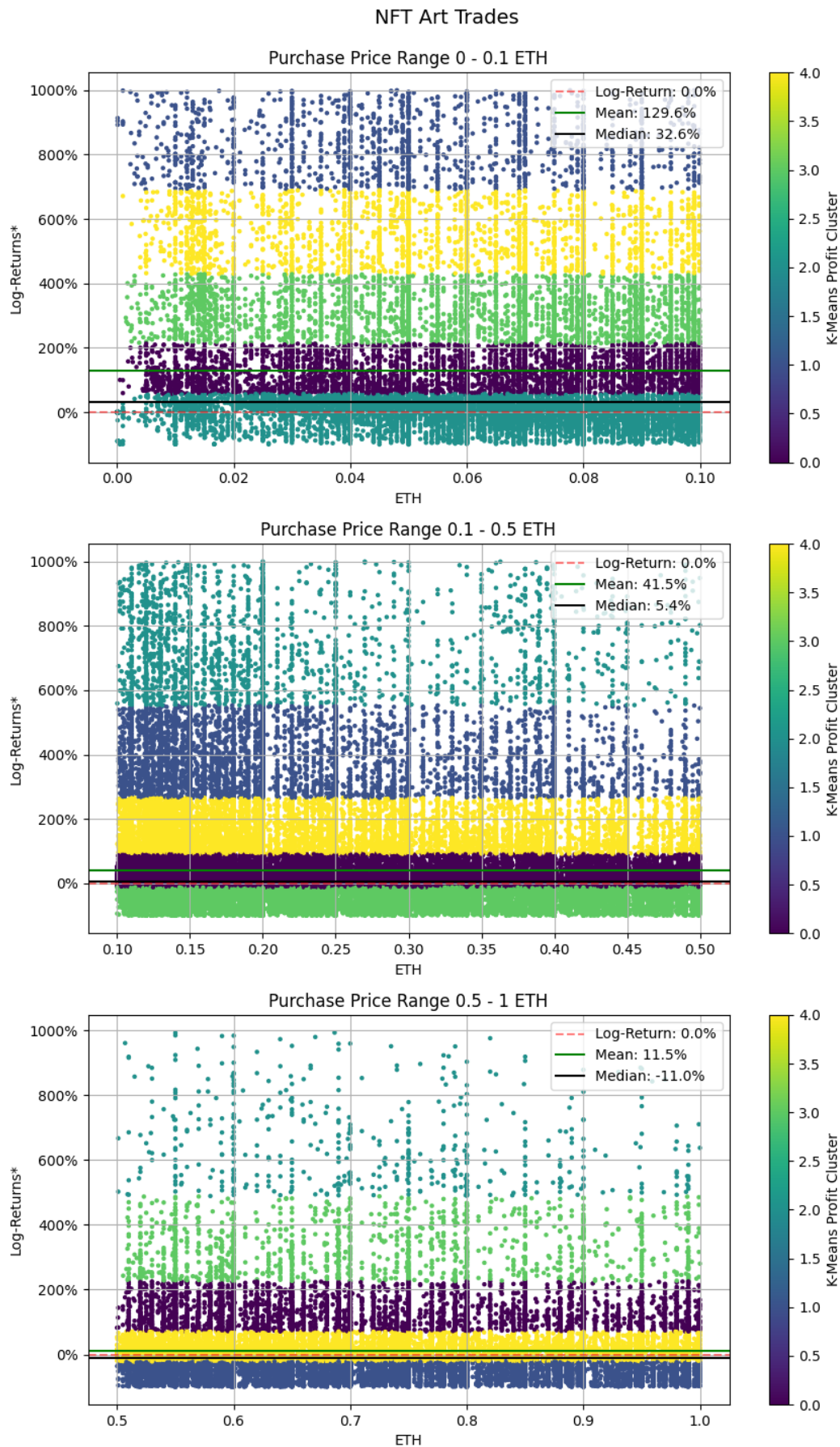
A good approximation of the annual arithmetic returns is then given by the cross-sectional variance of the return can be estimated in the second stage of the Case-Shiller repeat-sales regression under the assumption that it is constant over time (Goetzmann, 1992). This specification

corrects for a downward bias of the arithmetic mean that is due to the log transformation of the art prices. The return estimates can then be used to build a price index over the period of interest.

4.2 Data Manipulation and Clustering

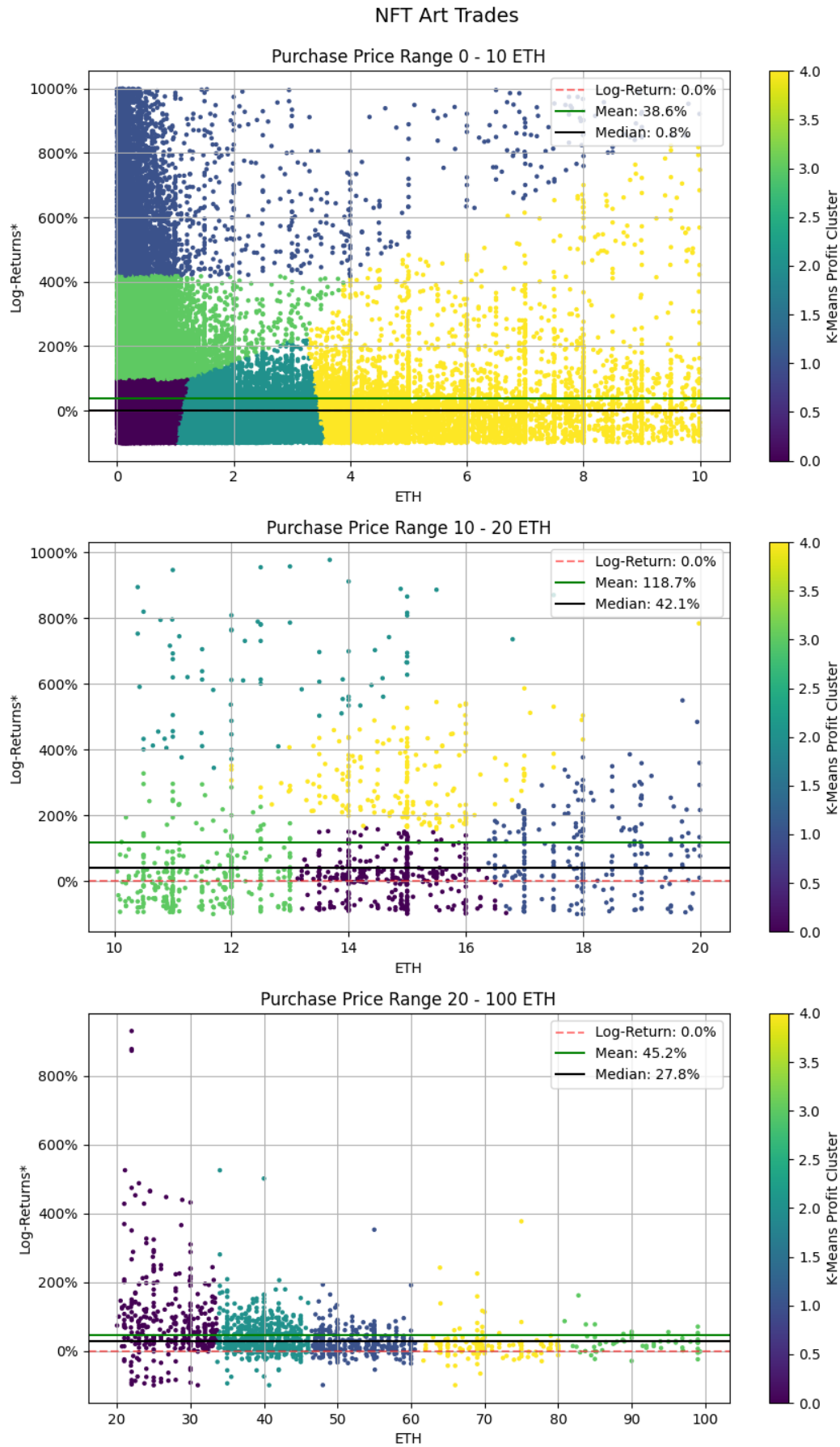
Pedregosa et al. [3]

4.3 Analysing the Clusters



*Log-Returns calculated for NFT prices measured in USD

Figure 1 NFT Trades



*Log-Returns calculated for NFT prices measured in USD

Figure 2 NFT Trades
20

5 Conclusion

NFTs themselves and the markets created to buy and sell them are new and do not carry the centuries of tradition, norms, legal frameworks, and community practices that surround the traditional art market. NFT artworks can rapidly benefit from innovations in their creation and purchase and sale. They may also emerge as a new frontier for tech-savvy criminals.

Financial Return + Consumption Value of Art vs. Risk (i.e. total loss)

5.0.1 The Future of NFTs for Art and Collectables

As discussed in earlier sections, the NFT art market sits at the crossroads of cutting edge technology (Section 2) and the traditional art market (Section 3). This collision has created a unique digital culture and a digitally realized marketplace (Section 4 and Section 5), results that have the potential to empower artists by adjusting the balance of market power in their favor. We foresee multiple potential paths for the future for the NFT art market. The first would empower artists with unprecedented control of the sale and resale of their work, facilitate the creation of high-tech work, and grant access to profits in previously impossible ways. The other is a picture of dysfunction: bots snapping up pieces and excluding most attempted market participants, artists unable to execute more control over the sale of their work due to lack of technical knowledge, and undetectable art-related crime. The true future of the NFT art market is likely to contain features from both visions, so we discuss elements of both.

Bibliography

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A Appendix

A.1 Collections

0xmons.xyz	Killer GF
10KTF	Kitty Crypto Gang
3Landers	KnownOriginDigitalAsset
8SIAN	Lil Heroes
AIMoonbirds	Lives of Asuna
AVASTAR Token	Lost Poets
Anatomy Science Ape Club	MAX PAIN AND FRENS OPEN EDITION BY XCOPY
ArtAI	MOAR by Joan Cornella
Async Art	Meta Eagle Club
Autoglyphs	MidnightBreeze
Avid Lines	Mindblowon
Beeings	Murakami.Flowers
Beeple Round 2 Open Edition	Mutant Garden Seeder
Black Box	NFTBoxes
Bloot	Noodles
Boki	OGCR
Boonji Project	PeopleInThePlaceTheyLove
BoredApeYachtClub	Phanta Bear
C-01 Official Collection	Pop Art Cats
Cold Blooded Creepz	QQQ Mint Pass
Corruptions	RareApepeYachtClub
Crypto Coven	Rarible
CryptoArte	Rektguy
CryptoJanky	Reptile Armoury
Cypher	SUPERPLASTIC: SUPERGUCCI
Deafbeef	Sneaky Vampire Syndicate
Desperate ApeWives	Squishiverse
Dippies	Super Cool World
Divine Anarchy	SuperRare
Elemental	TRAITORS by XCOPY
Fat Ape Club	Terraforms
Feline Fiendz	The Art of Seasons
First	The Surreals
Fishy Fam	TheCurrency
ForgottenRunesWizardsCult	Tubby Cats
Fragments By James Jean	Voxies
GODA Mint Pass	Waifus
Generativemasks	Weirdo Ghost Gang
Gh0stlyGh0sts	Women Rise
God Hates NFTees	Women and Weapons
Hashmasks	WonderPals
Hello, i'm Victor FEWOCiOUS And This is My Life!	YOLO
Incognito	inbetweeners
Karafuru Gachapon	merge.
Karafuru	

Statutory Declaration

I hereby declare that, to the best of my knowledge and belief, this thesis titled *NFT Art, an Investment Alternative for Everyone?* is my own, independent work. I confirm that each significant contribution to and quotation in this thesis that originates from the work or works of others is indicated by proper use of citation and references; this also holds for tables and graphical works.

Frankfurt am Main, 10.11.2022

Viktor Fendesak