PRICE DISCOVERY IN THE **NFT MARKET**

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CONTENTS

HIGHLIGHTS

■ This paper examines the price discovery mechanism of non-fungible tokens, or NFTs. That is, how do the forces of supply and demand determine an NFT transaction? We use data on some 55,000 unique NFTs with 16,000 creators/artists, and 15,000 collectors/buyers on Foundation, one of the largest NFT exchange platforms, to address this question.

■ NFT markets are well placed to democratise the global art economy. In the traditional art market, exhibiting artwork normally includes a transactional cost (such as a search or platform/hosting fee) upwards of 33 percent (Artquest, n.d). On the other hand, NFT listing on a platform involves no cost, and a lower commission on transactions (under 15 percent on Foundation). The lower transactional costs increase allocative efficiency, unlocking a higher volume of trades.

■ In the traditional set-up, galleries play a pivotal role in determining prices and deciding which artworks to promote. With NFTs, exchange platforms play a minuscule role in price-setting or censorship, lowering the barriers to entry and creating a more open art market. NFT platforms also let creators and collectors negotiate transactions directly, making it easy to complete even low-value sales.

■ These considerations prompt us to ask how the major attributes of NFTs govern their exchange. The attributes include data on creators, bidders and collectors, NFT listing details, that is, mint date, bid amount, sale price, creator earnings, Ethereum (ETH) price on the day of the transaction, the number of people who follow a creator on Foundation or Twitter (followers), and the number of people followed by a creator on these platforms (influencers).

■ We find that NFT collectors have a relatively concentrated distribution than NFT creators. This implies that collectors have greater bargaining power than creators. Subsequently, creators strategically approach collectors to break into relevant market networks, and to build relationships for future transactions.

■ NFT prices reveal a growing pattern and a positive correlation with ETH prices. Typically, a one percent increase in ETH prices leads to an average increase of 0.9 percent in NFT prices. This implies that a higher ETH price signals a more positive investor sentiment, which crowds-in new investors and prompts existing investors to transact more aggressively. Interestingly,

57 percent of the time the two series move in the same direction (i.e., both rise or fall together) while the rest of the time they move in opposite directions.

■ The number of bid counts on an NFT sends a strategic signal to creators. At a lower number of bids, they reduce their offer price by a small amount. They take no action at an intermediate number of bids, and increase their offer price prominently at a higher number of bids. The range for this price adjustment is typically between -7 and 23 percent.

■ A one percent increase in the number of Foundation followers leads to an average 0.2 percent increase in the price of NFTs sold by a creator, while the corresponding increase with Twitter followers is 0.12 percent. For creators, a higher number of followers signals an uptick in collector interest, a position they leverage to sell their artworks at a higher price.

■ A one percent increase in the number of influencers on Foundation decreases the NFT selling price by 0.13 percent, and on Twitter by 0.07 percent. These estimates suggest that creators, when following others to grow their network, reduce the price of their artworks as an incentive. A larger network builds reputation on the platform, which tends to be rewarding in the longer run.

■ There is tremendous potential for the NFT-based creative economy in India, but the public policy recipe to grow this market needs an environment conducive to (a) improving allocative and productive efficiency in the market, and (b) fostering innovations to make it more inclusive and institutionally based. This is achieved through perfect information disclosure, inclusion of all potential collectors in the NFT marketisation process, and incentivising the NFT market towards adopting best-practice technological and managerial processes.

1. INTRODUCTION

This paper examines the forces of supply and demand governing the marketisation of non-fungible tokens, or NFTs. NFTs are crypto-assets built over the blockchain technology that let individuals own digital artworks in the form of images, videos, audio, even memes. NFTs are an innovative way for creative communities to showcase their work digitally, and tap the global demand for their creations. Broadly, there are six categories of NFTs currently in the market – Collectibles, Art, Metaverse, Gaming, Sports and Utility NFTs. Those in the art category include digital artworks in the form of images, videos and music, while gaming NFTs are crypto-assets that can be used in virtual games.[i]

Given the extensive potential of NFTs to stir economic activity, especially in their marketisation, it is important to examine the forces of supply and demand that govern their value. These include factors such as the number of bids, characteristics of the underlying technology, exchange platform, network characteristics (i.e., followers, who follow creator accounts; and influencers, who are followed by creators and may influence them on the latest trends) and the role of social media. An assessment of these factors and the corresponding transaction price can provide vital information on the current state and future appeal of the NFT market.

Two additional reasons motivate the study. One, NFTs are an opportunity for countries to tap into their creative economies. India has an abundant pool of creative content in the form of traditional art, craft, dance, music and other forms, but the contribution of the creative economy to its GDP remains a paltry 0.58 percent, just a tenth of the global average (Patnaik 2020). Large-scale NFT adoption in India may have the potential to increase this contribution significantly. Two, NFTs can be used to represent collector rights and control over a digital work. This can lead to an entirely new economic arrangement by redistributing value (and control) from the intermediaries or distributors, who occupy the central position in the internet economy, to creators. Thus, examining the price discovery mechanism of NFTs can offer vital insights into the potential contribution of NFTs to the economy.

For our empirical assessment, we use data from the Foundation platform. In operation since February 2021, Foundation is an NFT platform built on

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i. Annexure A presents a taxonomy relevant to this paper. Annexure B lists examples for each of the categories.

the Ethereum (ETH) blockchain network. It allows a creator to invite new creators, collectors and other market participants to the network, leading to organic network formation between them. We use data on 54,866 unique NFTs transacted between 6 February 2021 and 30 April 2022 for the current exposition. The major NFT attributes we analyse include the corresponding details of creators, bidders and collectors, mint date, bid amount, sale price, creator earnings, and the follower and influencer count on the Foundation and Twitter handles of creators and collectors.

First, we take a close look at the market structure of the NFTs through several ratios and time plots. The key parameters for this assessment are the concentration of creators and collectors, role of reputation on the platform, and correlation between the number of bids, ETH prices and NFT sale value. We then employ a multivariate least squares regression to examine the role of factors such as the number of bids, characteristics of the underlying technology, relevant network characteristics (followers and influencers) and social media on NFT prices.

Five key results emerge from the empirical exercise. (A) there are no dominant creators influencing the NFT market, though there are a few collectors with a dominant market position. This implies that collectors have more bargaining power than creators, and establishing a relationship is a key strategy to execute a transaction. (B) Reputation is a key strategic asset for both creators and collectors, and often bestows a premium over and above a random market transaction. (C) Creators dynamically adjust their offer price to attract bids. The typical range for this adjustment is -7 to 23 percent. (D) Creator earnings increase with the number of followers and decrease with the number of influencers. The rise is generally larger than the fall. (E) A one percent increase in ETH prices leads to an average increase of 0.9 percent in NFT prices. This correspondence is mostly driven by market sentiments.

These results offer several implications for public policy, which we discuss from the standpoint of improving allocative and productive efficiency. We also deliberate on the innovations needed in the NFT market to make future transaction relationships inclusive and institutional. Overall, this report presents an incisive understanding of the NFT market and of its economic potential. The novelty of the study is in contextualising the NFT market through an economic policy lens.

2. SURVEY OF LITERATURE – SALIENT FEATURES OF NFTS

In the existing literature, the discussion on NFTs largely centres on (a) the correlation between NFTs and crypto-assets such as ETH or Bitcoin (BTC), (b) the adoption of NFTs, (c) creator networks and reputation, (d) the scarcity, liquidity or utility of NFTs. We take a closer look at each of these below.

A. CORRELATION BETWEEN NFTs AND CRYPTO-ASSETS

Since NFTs are crypto-assets transacted using blockchain technology, crypto-assets themselves are often the medium of their transaction. ETH is the most widely used among them. Thus, it is expected that price fluctuations in ETH (or other crypto-assets) will correlate positively with those in NFTs. There are additional factors that may dictate whether this correlation is strong or weak. For example, while NFTs are primarily used as assets with a creative or artistic value, crypto-assets mainly act as a currency, being a medium of exchange, store of value, or a means to exploit arbitrage opportunities. Therefore, while the two assets may have a positive correlation, its strength will depend on user behaviour in a given period. If users attach little weight to the function of ETH as a store of value or a means of exploiting arbitrage opportunities, we may find that its correlation with NFTs as strong. The correlation would turn low in the contrary case.

Dowling (2022) analyses the correlation between ETH on one hand and NFTs on three platforms – Decentraland, CryptoPunks, and Axie Infinity – on the other. His findings suggest that the spillover effect via volatility transmission remains under 14 percent between the two markets. Decentraland NFTs portray the largest spillover effect, with volatility transmission of as much as 24 percent for BTC and ETH collectively. The volatility transmission of CryptoPunks and Axie Infinity NFTs remain at 10.5 and 5.72 percent respectively. These results imply that while there is a positive correlation between crypto-assets and NFT prices, the strength of the correlation depends on the crypto-assets and NFT collection in question. Ante (2022) also examines the extent of correlation between the two markets. Using a causal analysis, the study finds that BTC and ETH pricing affects the NFT market (i.e., sale value and the number of wallets), while the NFT market does not significantly influence the pricing of these crypto-assets. It also shows that the effect of BTC and ETH price fluctuations is mainly confined

to the smaller NFT markets. This reinforces the finding that the correlation between crypto-assets and NFTs is almost always positive, while the strength of the correlation may be high or low depending on the NFT and the behaviour of relevant users.

B. STAGES OF NFT ADOPTION AND EARLY MOVER ADVANTAGE

The diffusion of new technologies typically occurs through three temporal stages (Rogers 2010, Lengyel et al 2022). These are (a) an early stage where innovators and a few early adopters, typically opinion leaders with a central position in a network, are the principal drivers; (b) a majority stage, where a large number of late adopters, with little or moderate opinion leadership, follow the innovators and early adopters; and (c) a laggard stage, where a moderate to low number of adopters follow the majority and have negligible opinion leadership.

Vasan et al (2020), in looking at these temporal stages for NFT adoption, show there is a clear early-mover advantage for both collectors and creators. The earnings of early creators as well as the spending of early collectors were higher than their peers who joined the NFT platform later. Early adoption helped them form stronger and more credible networks on the platform.

C. REPUTATION AND NETWORK OF THE CREATORS

Unlike the traditional art market where intermediaries such as art galleries and museums help establish a creator's reputation, it depends on the creator's centrality in the platform as well as her duration of stay on an NFT platform. Vasan et al (2022) notes three important characteristics of creator reputations on NFT platforms. One, the sale price of artworks by a reputed creator is generally more stable than for those building their reputation. Two, the time taken for a reputed creator to attract a bid on her artwork is almost half of creators with lower reputation. Three, a reputed creator typically has a loyal collector base, who tend to make repeated expensive purchases. Less reputed creators by contrast have a random collector base. These characteristics imply a high degree of correlation between creator reputation and earnings.

Homophily is a key feature of creator networks on an NFT platform. In other words, contact between similar creators occurs at a higher rate than at random, and newly invited creators develop similar engagement and sales patterns to the creator who invited them. The principal attributes of this homophily are earnings per artwork, number of artworks sold, and number of followers on

an NFT platform. Vasan et al (2022) shows that this homophily leads to the emergence of rich and poor clusters of creators, where the distribution of average earnings per artwork per creator in each cluster is skewed towards the right. Creators in a few clusters earn a lot more than they would have earned at random.

D. SCARCITY, LIQUIDITY AND UTILITY

Hays et al (2021) examines the role played by the scarcity, liquidity and utility of NFTs in driving their value. The study notes that there is often a premium attached to these attributes. For instance, some creators mint a limited supply of NFTs (by digitally adjusting the supply) to create a perception of exclusivity in the eyes of their audience. NFTs in the collectible category are often created with such intentions. They are priced higher than regular collections, on account of a rarity/scarcity premium in their valuation. Further, NFTs minted on a platform with many users and multiple payment options tend to be priced higher than those on a platform with few users and payment options. This indicates a liquidity premium for NFTs that are easy to transact. Finally, some NFTs offer more utility than others, such as offering access to special clubs and services, or even providing physical goods to the collector after the transaction. These not only serve as a piece of art that is exclusive to the collector, but provide additional benefits as well, and are priced higher than other NFTs on account of the utility premium.

We keep these stylised points in mind while carrying out our empirical exercise, for which the data and method are discussed below.

3. DATA AND METHOD

A. Data source

We use data on NFTs from the Foundation platform in the period between 6 February 2021 and 30 April 2022.[ii] Foundation includes NFTs at all three stages of adoption (early, majority and laggard) mentioned above in Section 2 (Summary of Salient Features). Hence, the sample data is representative of the entire creator population on Foundation in particular, and NFTs in general.

The sample comprises 54,866 unique NFTs, 16,288 unique creators and 15,009 collectors, with an average of 3.37 tokens per creator and 3.66 per collector. The average selling price is ETH 0.92 (equivalent to USD 2,588.3) with the corresponding coefficient of variation (the ratio of standard deviation and mean) at 11.82. This suggests considerable variation in NFT prices, which is a key requirement for generalising the results from this exercise. We convert NFT prices into USD by using daily ETH trading price data from investing. com. The number of bids for an NFT also presents an interesting picture. Nearly 69 percent of NFTs attract a single bid, 11 percent attract 2 bids, 7 percent attract 3 bids, and only the remaining 13 percent attract over 3 bids each. Finally, we find that nearly 44 percent of creators have a Twitter handle, suggesting that social media may play an important role in attracting bids for an NFT transaction.

B. Methodology

The empirical methodology focuses on two important aspects. One, where we disentangle the market structure (i.e., the supply-demand dynamics) of NFTs on the Foundation platform. For this purpose, we look at data such as the unique number of collectors and creators, number of bids, and NFT sale values on a month-on-month basis.

Two, we consider the role of an array of factors in influencing NFT prices in a multivariate setup, using a least squares regression. Specifically, we regress NFT selling prices on the number of bids, ETH prices, and number of followers and influencers on Foundation and Twitter. We also include squared terms of these explanatory variables to account for non-linearities

ii. This data is available on GitHub. Vasan et al (2022) provide an open-source code for its extraction.

in their association with NFT prices. Finally, we account for the time-variant effects on NFT prices by using dummies for months (for each year).

We consider two additional estimation issues for robust results. First, the distributions of several variables reveal extreme values. This may bias the result, as statistical means are sensitive to extreme values. We get over this difficulty by winsorizing five percent of observations at extremes for these variables. Second, we convert all variables into natural logarithms, except the number of bid counts. Log transformation controls for excess variability in the data, improving the accuracy of the results. The coefficient associated with a log transformed variable, in the regression, can be interpreted as elasticities (the percent change in NFT prices due to a one percent change in the value of that variable). Table 1 presents summary statistics of the variables used in the estimation.

Table 1: Summary Statistics

| | NFT PRICE, IN USD | BID COUNT | ETH PRICE, IN USD | FOUNDATION | | TWITTER | |
				FOLLOWERS	INFLUENCERS	FOLLOWERS	INFLUENCERS
Mean	2588.3	2.1	2960.9	231.8	100.7	8158.3	1052.8
Median	980.2	1.0	3005.4	107.0	33.0	912.0	557.0
Coefficient of variation	10.73	1.24	0.30	1.62	6.9	7.15	3.63

Note: These statistics represent 54,866 unique NFTs on the Foundation platform, collected in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022)

The next section discusses the NFT market structure, followed by the results from the multivariate least squares regression.

4. NFT MARKET STRUCTURE

We construct several parameters on a month-on-month basis from our sample data to assess the market structure of NFTs traded on the Foundation platform. These include concentration in the NFT market, correlation of NFT sale value with ETH price, collector-creator ratio, and bid-sales ratio (Figures 1-4). Four interesting results emerge.

One, the major difference between how creators and collectors are distributed in the NFT market is in their respective concentration, as can be seen through the Lorenz curve in Figure 1. While 10 percent of creators float nearly 44 percent of NFTs, 10 percent of collectors account for approximately 68 percent of NFTs. In contrast, the bottom 10 percent of creators and collectors account for only 0.8 and 0.1 percent of NFTs, respectively. Using the oft-quoted Herfindahl–Hirschman index (HHI), the concentration in creator and collector distribution is 14 percent and 29 percent, respectively. This implies that there are a few collectors who have a dominant position in the market, while there are no dominant creators influencing the NFT market.

Two, taking a closer look at the NFT creator and collector distribution, Figure 2 shows that the number of unique NFT collectors is falling on a month-on-month basis, while that of unique NFT creators is rising. The simultaneous fall and rise in the number of creators and collectors respectively suggests that collectors have more bargaining power than creators, as they represent the shorter side of the market. And that for creators to perform an exchange it is important to break into the collectors' network. Once this network is formed, it bestows a premium on creators – as quick transaction execution, or the receipt of better prices, or establishing a relationship for future transactions. This observation is in line with the inferences from the existing literature noted in Section 2.
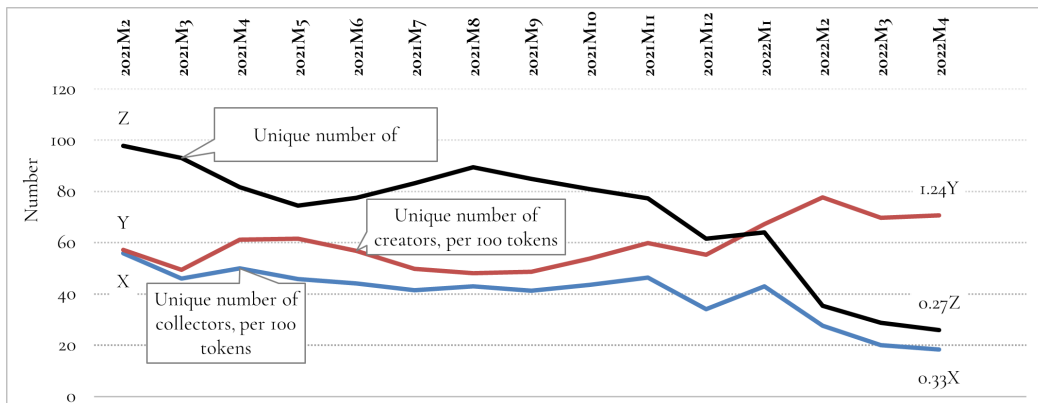
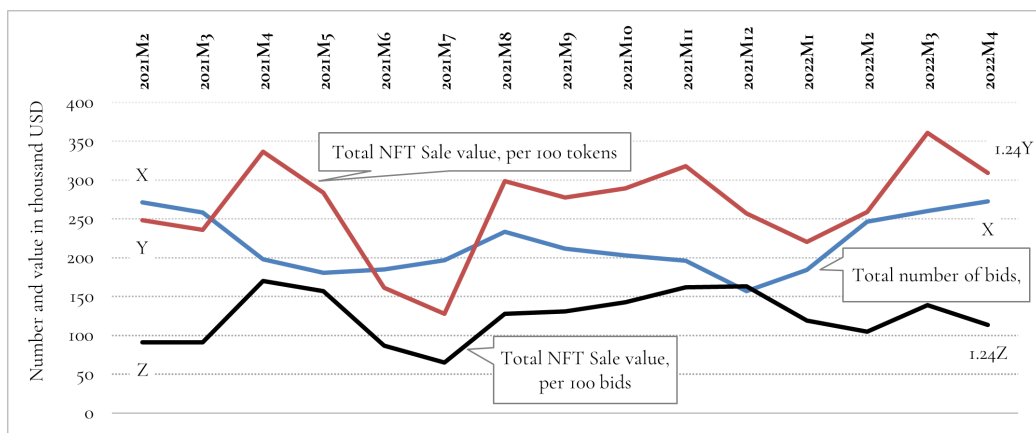## Figure 1: Distribution of Creators and Collectors, and NFT Holding
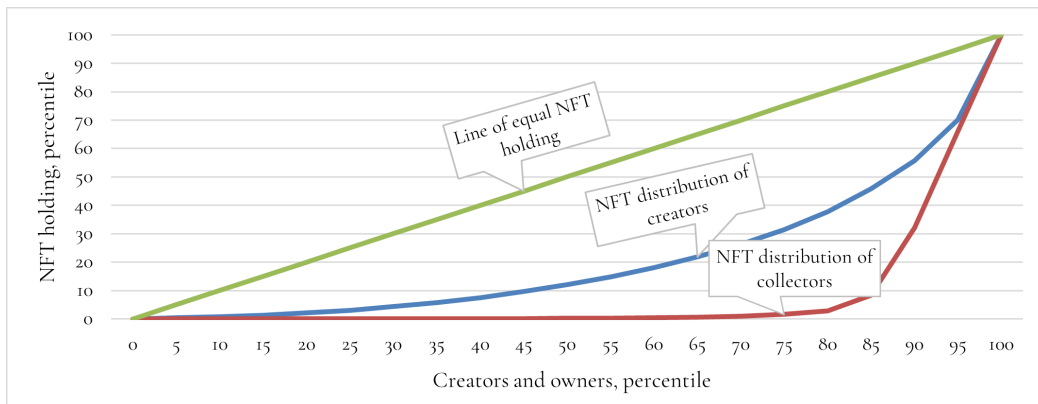
Note: This figure represents 54,866 unique NFTs on the Foundation platform, collected in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

Figure 2: NFT Collectors and Creators

Note: This figure represents 54,866 unique NFTs on the Foundation platform, collected in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

Three, the number of bids contains an interesting insight into the sale value of NFTs (Figure 3). While the competitive principle dictates a positive correlation between sale value and the number of bids, we do not find the correlation between the two series to be significant (the correlation coefficient between the two series is 0.29, with a p-value of 0.3). This makes it plausible that besides creator reputation, the reputation of the likely collectors is also important for an NFT exchange. As we saw in Figure 1, the concentrated distribution of collectors suggests that some of them are better able to execute transactions than others. This is either because of a historical exchange relationship, or their track record of buying NFTs, or creator's expectations of securing a future transaction by building a network. Other collectors, meanwhile, have limited success in executing a transaction for the same reasons above.
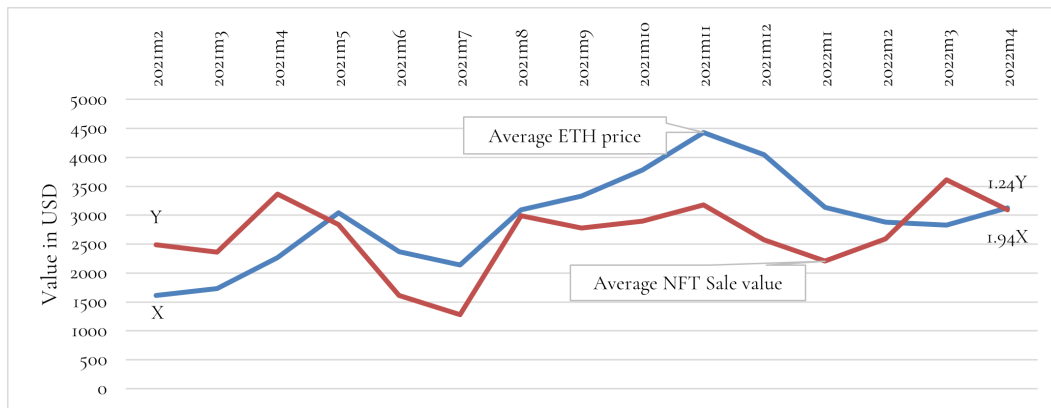
Figure 3: Number of NFT Bids and sale value

Note: This figure represent 54,866 unique NFTs on the Foundation platform, collected in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

Figure 4: ETH Price and NFT sale value

Note: This figure represents 54,866 unique NFTs on the Foundation platform, collected in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

Finally, as NFTs on the Foundation platform use the ETH blockchain, their prices are determined in ETH. Therefore, examining the correlation between NFT sale value and ETH price is of considerable interest. Figure 4 suggests that while both series reveal a growing pattern and a positive correlation, the coefficient of correlation at 0.385 is insignificant (p-value of the correlation coefficient is 0.16). Interestingly, nearly 57 percent of the time the two series moved in the same direction (i.e., both series rose or both series fell), while the remaining 43 percent of the time they moved in opposite directions.

On the whole, reputation and network between creators and collectors seem to be the key driving forces in NFT transactions. The noted concentration in creator and collector distributions seems to be an offshoot of their respective reputations and networks, although collectors hold relatively more bargaining power than creators.

Notably, the results in this section use an uncontrolled framework. In the next section we take a closer look at the price discovery mechanism of NFTs in a multivariate setup.

5. ESTIMATION RESULTS

We use the least squares regression to examine the price discovery mechanism of NFTs. The explanatory variables for this regression include bid counts, ETH prices, number of followers on Foundation and Twitter, number of influencers on Foundation and Twitter, and the squared terms of these variables. Figures 5-10 present the marginal effects from the regression.

A. Marginal Effects of Bid Counts

Figure 5 shows the marginal effects of bid counts on NFT prices. It shows an interesting feature of the NFT market that once a creator receives only one bid, they lower the selling price to incentivise more bids (i.e. the marginal effect at the 10th, 25th and 50th percentile). As the number of bids increases to two (the 75th percentile), creators do not change the NFT selling price. As the number of bids increases further (90th percentile with number of bids at five), creators derive an unequivocal signal about their offering's popularity, which prompts them to increase the price of their tokens.

The non-linear marginal effects of bid counts, therefore, depict a strategic move by creators. They reduce their offer price by small amount at a lower number of bids (by seven percent when the number of bids is one), do nothing at an intermediate number of bids (when the number of bids is two), and increase their offer price considerably at a larger number of bids (by 23 percent when the number of bids is five).

Figure 5: Marginal Effects of Bid Counts
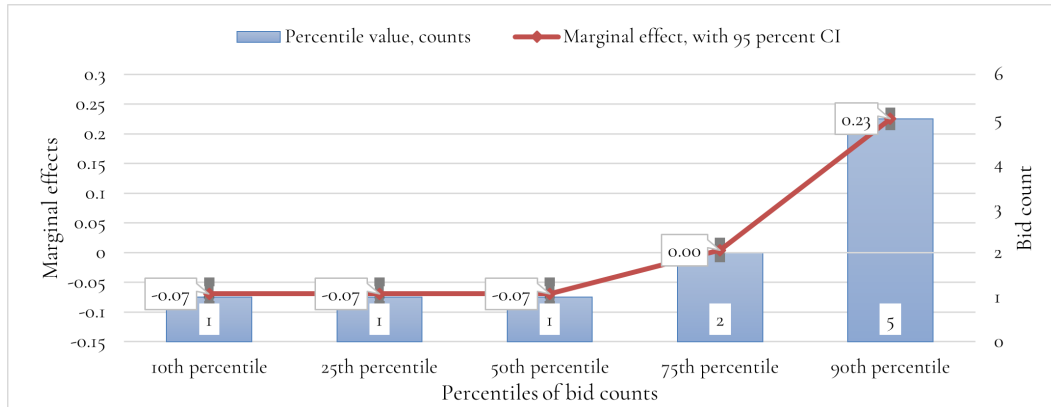
Note: This figure represents the marginal effects of bid counts on NFT selling price (in natural logarithm). The sample for the regression consists of 54,866 unique NFTs on the Foundation platform in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

B. Marginal Effects of ETH Prices

Figure 6 depicts positive and increasing marginal effects of ETH prices on NFT prices. That is, a one percent increase in ETH prices at the 10th percentile leads to a 0.63 percent increase in NFT prices, which increases to 0.89 percent at the 50th percentile (the median) and to 1.27 percent at the 90th percentile. The positive marginal effects are in line with expectations, given that ETH is the medium of NFT exchanges. However, the increasing marginal effects at subsequent percentiles of ETH prices indicate an interesting feature of the ETH market. A higher ETH price signals a more positive investor sentiment, which not only crowds-in new investors, but also prompts the existing investors to transact more aggressively.[iii] Creators respond to this signal by increasing the price of their offerings as ETH prices increase.

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iii. We checked the correlation between ETH prices and investor sentiments (proxied by the S&P-Twitter sentiment index), using daily data for the current sample period. We find this correlation to be positive.
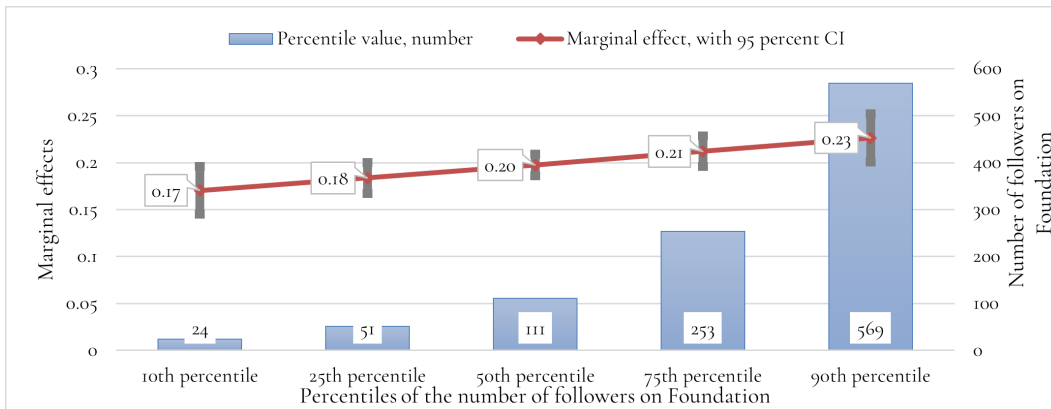
Figure 6: Marginal Effects of ETH Prices
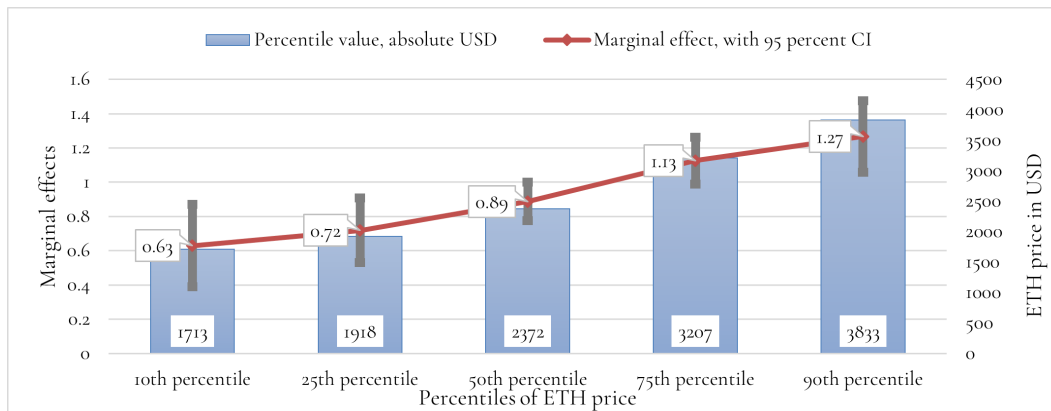
Note: This figure represents the marginal effects of ETH price on NFT selling price. Both variables are in natural logarithm. The sample for the regression consists of 54,866 unique NFTs on the Foundation platform in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

C. Marginal Effects of the Number of Followers on Foundation and Twitter

The number of followers on Foundation and Twitter have positive effects on NFT selling prices, as can be seen in Figures 7 and 8 respectively. Our findings suggest that a one percent increase in the number of Foundation followers, at the median, leads to a 0.2 percent increase in the price of NFTs, while the corresponding increase is 0.12 percent for Twitter followers. However, the marginal effects of these two variables are not significantly different across percentiles. This indicates a threshold in the effect of the number of followers on Foundation and Twitter on NFT prices. Only until a creator achieves a certain number of followers on Foundation or Twitter does their effect on NFT prices increase significantly. Beyond this threshold, the additional effect of the number of followers on NFT prices is insignificant.
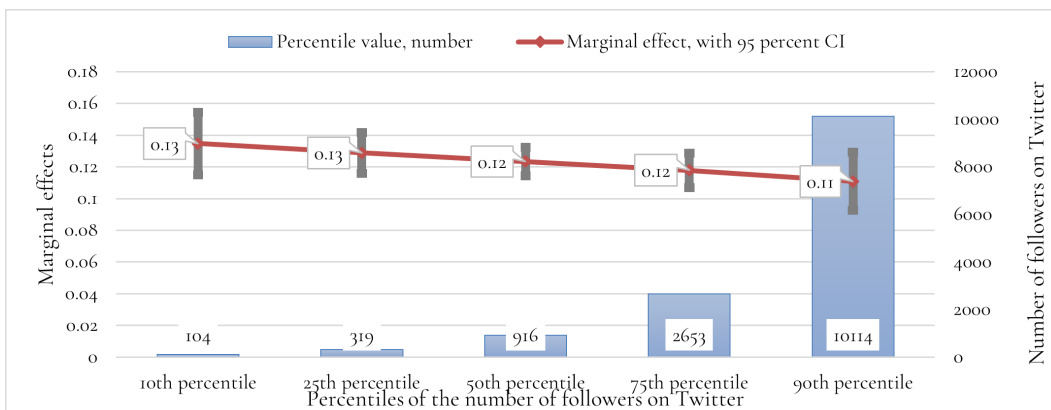
Figure 7: Marginal Effects of the Number of Followers on Foundation

Note: This figure represents the marginal effects of follower count on NFT selling price. Both variables are in natural logarithm. The sample for the regression consists of 54,866 unique NFTs on the Foundation platform in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

Figure 8: Marginal Effects of the Number of Followers on Twitter
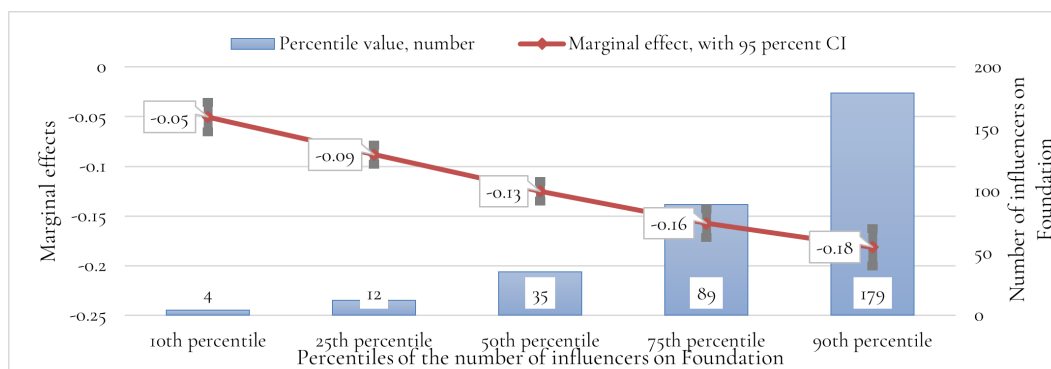

Note: This figure represents the marginal effects of follower count (Twitter) on NFT selling price. Both variables are in natural logarithm. The sample for the regression consists of 54,866 unique NFTs on the Foundation platform in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

D. Marginal Effects of the Number of Influencers on Foundation and Twitter

The number of influencers on Foundation and Twitter has a negative effect on NFT selling price, as seen in Figures 9 and 10 respectively. At the median, a one percent increase in the number of influencers on Foundation decreases NFT selling price by 0.13 percent, and on Twitter by 0.07 percent. These estimates suggest that a creator who wishes to grow their network offers price cuts as an incentive. The extent of the incentive increases with the intended growth in network size.[iv]

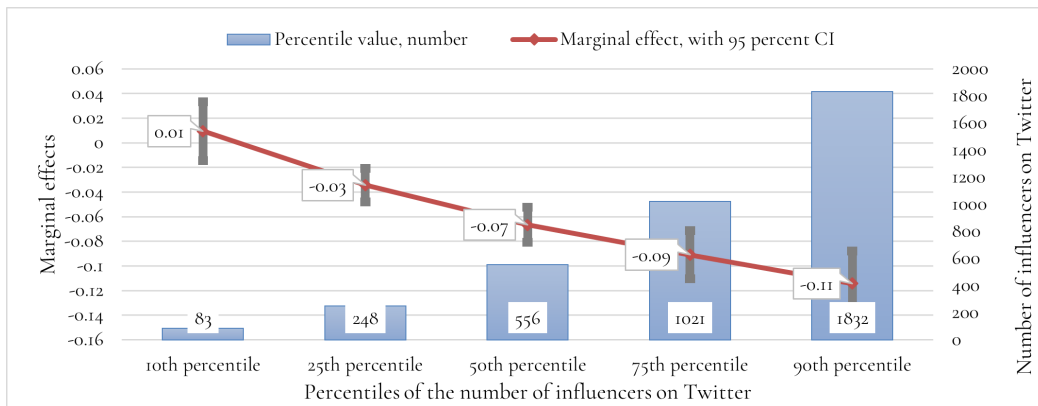Figure 9: Marginal Effects of the Number of Influencers on Foundation

Note: This figure represents the marginal effects of influencer count on NFT selling price. Both variables are in natural logarithm. The sample for the regression consists of 54,866 unique NFTs on the Foundation platform in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

However, on aggregate, the effect of networks (followers and influencers taken together) on NFT prices seems to be positive, although the size of the effect is small. Given that network effects often follow an exponential path, they are likely to become more pivotal as the NFT market matures.

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iv. It is plausible that these incentives may have a medium-term benefit. A deep dive into this aspect would require a longer sample period. Due to limitations of data availability, it is beyond the scope of the current exercise.

Figure 10: Marginal Effects of the Number of Influencers on Twitter

Note: This figure represents the marginal effects of influencer count (Twitter) on NFT selling price. Both variables are in natural logarithm. The sample for the regression consists of 54,866 unique NFTs on the Foundation platform in the period between 6 February 2021 and 30 April 2022.

Source: GitHub, Vasan et al (2022), investing.com

6. CONCLUSION

The NFT landscape is continuously evolving, creating opportunities to market art and other digital articles. At the same time, it offers the potential to tap into the creative economy, which is so far locked in India. To guide investors, policymakers and other stakeholders in this market, therefore, it is important to examine the forces of demand and supply that drive it. This report takes a step towards filling this gap.

Using data on 54,866 unique NFTs with 16,288 unique creators and 15,009 collectors, we generate three useful insights. First, the NFT market is marked by strategic interaction between creators and collectors, with the major tools of this interaction being their respective networks, establishing intertemporal relationships, and assessing other market signals such as ETH prices and the number of bids. In such strategic markets the scope for policy intervention, in principle, is mainly in improving allocative and productive efficiency. Improving allocative efficiency requires policy intervention focused on perfect information disclosure and seamless inclusion of all potential collectors in the NFT marketisation process. There have been several relevant policy actions in the banking and security markets in this regard. These include mandating Know-Your-Customer (KYC) compliance and/or periodic sharing of guidelines and principles meant to educate the general public for informed decision making.

Improving productive efficiency meanwhile entails prompting the NFT market to dynamically adopt best-practice technological and managerial processes. On both these counts, NFT exchanges can form the basis of these improvements most coherently, as targeting individual creators and collectors (including potential ones) is infeasible in practice. Lastly, for orderly growth of the NFT market, transaction prices, directly or indirectly, should be left to market forces to decide.

Second, establishing a future transactional relationship between creators and collectors is an important feature of the NFT market. The data suggest that such a practice is privately managed. While this confers an advantage on incumbents in forging a relationship, it may crowd-out new entrants from such relationships. To take care of this contingency, it is important for

innovations in the NFT market to adopt specific instruments targeted at making future contracting more systematic and institutionally driven.

Finally, market sentiments are a key driver of NFT transactions, at both the extensive and intensive margins. This means the policy uptake should have a behavioural paradigm for prescriptions and interventions. The traditional understanding of risks and returns may be of limited relevance in propelling the NFT market – rather public policy should dynamically engage in assessing stakeholder perceptions and expectations about the market. This can be achieved by inviting regular consultations from stakeholders on matters aimed at improving ease of transaction, user safety, informed decision making, etc.

By spelling out the recipe to grow the NFT market, these results build a case for increasing the size of the creative sector in the Indian economy, with focus on the relevant institutional prescriptions outlined above. India has a rich collection of cultural and historical artifacts, along with a wide spectrum of artistry. It is also one of the prominent emerging locations for minting digital tokens. Yet the marketisation of these assets remains limited. NFTs present a use-case for marketising these assets. For example, the auction of some of Raja Ravi Verma's paintings on an NFT platform called RtistiQ generated earnings of USD 18,000 in two separate auctions in February and July 2022 (Rtistiq.com, n.d).

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ANNEXURE A: TAXONOMY

Non-interchangeability

These assets are unique in their features and cannot easily be exchanged with another asset because it is difficult to compare their values.

Fungibility

Fungible assets can be exchanged with other assets of equal value. They include commodities, such as precious metals, and currencies.

Smart contracts

These are digital contracts with a pre-defined set of rules, coded into the blockchain network. They are executed when the set of rules is met, and do not require an intermediary.

Minting

Minting is the process of creating an NFT. It requires a crypto wallet and a cryptocurrency to be used as fee.

NFT ownership

NFTs are usually purchased through an auction process. There can only be one owner of this asset at a given point in time. Once bought, the individual's private key encryption holds the NFT, and their public key is visible to others as proof of ownership.

Ethereum

An open-source, blockchain platform that uses Ether (ETH) as its native cryptocurrency and houses various crypto projects. It has smart contract functionality and is hence widely used for trading NFTs.

Creators

Individuals who create the artwork stored in an NFT. In the context of NFTs, the words creator and artist are often used interchangeably.

ANNEXURE B: NFT CATEGORIES AND EXAMPLES

Table 1: NFT Categories and Examples

NFT CATEGORIES	EXAMPLES
Collectible	Bored Ape Yacht Club, CryptoPunks
Art	Art Blocks
Metaverse	The Sandbox, Decentraland
Gaming	Axie Marketplace, Loot
Sports	NBA Topshot
Utility	Unstoppable domains, Zora

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