Examination of Facebook's Announcement Effect on Metaverse Tokens

Mr. Chalakorn Sathiwas

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นายชลากร สถิวัสส์

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Chalakorn Sathiwas : Examination of Facebook's Announcement Effect on Metaverse Tokens. Advisor: Assoc. Prof. Kanis Saengchote, Ph.D.

In this research, we study an announcement effect of Facebook Inc.'s rebranding to Meta Platform Inc. in October 2021, as a flagship event that sheds spotlight to the metaverse business, on 50 metaverse-related cryptographic tokens. Using Google's CausalImpact package in R with historical daily returns within -30,7 windows, the model expects a 11.80% counterfactual CAR but the actual CAR is 69.20%, indicating a 57.40% absolute effect of this announcement on aggregate metaverse tokens at 99% significant level.

We also further regress five factors, namely game-fi, marketplace, holders, illiquidity, and VC factor on the post-announcement CAR. However, the result is sparse. Only the constant and marketplace factor shows a positive and negative, respectively, impact at 90% level.

Our study makes two contributions; Firstly, the result indicates that metaverse tokens positively respond to the announcement in aggregate. Secondly, the abnormal returns of these tokens are mainly driven by the uniqueness of each token and the marketplace function is harmful to the

Field of Study:	Finance	Student's Signature .....
Academic Year:	2021	Advisor's Signature .....

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Chalakorn Sathiwas

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Introduction

On October 28th, 2021, the online social media giant, Facebook Inc., made an important announcement of rebranding to Meta Platform Inc., declaring its intent to pioneer the metaverse technology. The entire world interest suddenly spotlighted to the 'metaverse'.

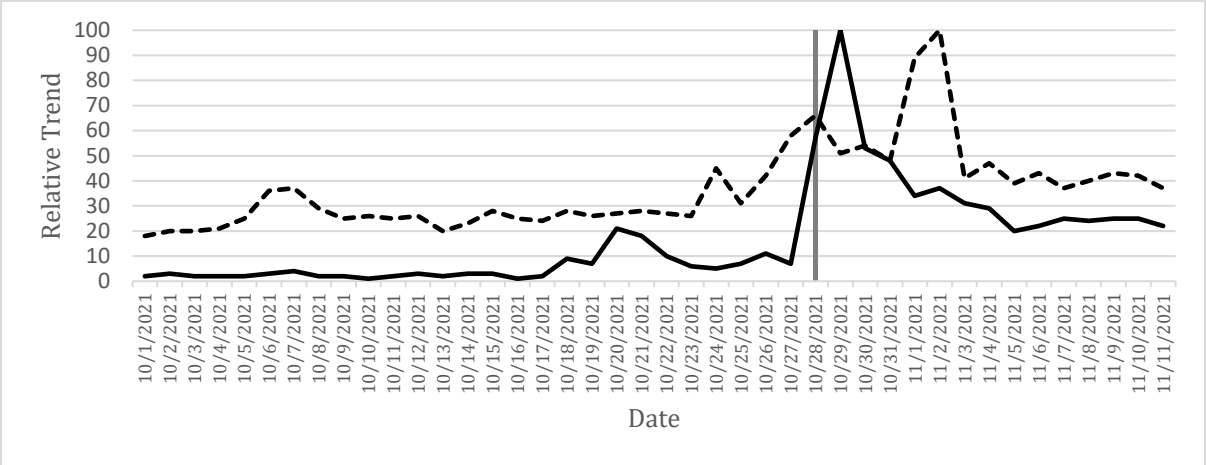


Figure 1 Google search trend of 'Metaverse' (black line) and 'Cryptocurrency' (dotted line) during October 1st-November 11th, a sharp peak can be spotted after the day of Facebook's announcement (vertical line)

Though it has been a sudden hype in just recent months following Facebook's rebranding, the terms 'metaverse' has existed much longer before. This word refers to an immersive technology which allows users to connect and collaborate in a virtual environment blending physical and digital, facilitated by the convergence between the Internet and Web technologies, and Extended Reality (XR). (Lee, Braud et al. 2021) Though the XR technology, the application is not limited to only a Massively Multiplayer Online Game (MMOG), but has also been under development and implemented in various disciplines e.g., MICE business, autonomous vehicles, surgery operations, interactive advertising display, etc.

At the present time, human cannot yet achieve the true converged world where reality and virtual reality are perfectly blended due to several technological constraints. Fortunately, the advent of Artificial Intelligence (AI) technology and the emergence of the cryptocurrency narrow the gap between two worlds: a blockchain technology to build up a transparent and reliable economic system in the virtual world using cryptocurrency to overcome the constrain of fiat currency that is limited to transaction amount and regulations, and, an AI to enrich the contents in the virtual world, as well as to automate transactions and to make a financial decision. (Ynag, Zhao et al. 2022)

Facebook's rebranding can be considered one of the key events that stimulate investment community's interest toward the metaverse and potentially lead to the advance of this technology. Our literature examines the announcement effects of Facebook's rebranding on metaverse-related cryptocurrencies and cryptographic tokens whether there exists an abnormal return during the observation period around the announcement, as well as the characteristics of the metaverse coins than contribute to that abnormal return.

This paper makes two main contributions. We expand our knowledge about the metaverse which is a nascent and largely unexplored area, especially in financial aspect. We also conduct a

further investigation on the inherit characteristics the drive the metaverse token price, compared to the existing literatures that give a broad explanation that prices of cryptocurrency are driven by a market factor. We expect that by reading our paper, investor will have a better understanding regarding the tokens in the category and be able to apply to his/her investment strategy and entrepreneur will be able to know which factor that the market values so that he/she has higher chance of success in issuing the ICO in order to fund his/her metaverse project.

In this literature, we will begin with the Literature Review section will illustrate the existing concepts regarding the crypto asset valuations and similar cases of event study of cryptocurrency and how we build our hypothesis. An explanation of our observations and approaches are provided in **Error! Not a valid bookmark self-reference.** section. To pave a ground knowledge for the reader, the concept of the metaverse and cryptocurrency is available in Appendix.

Literature Review

Cryptocurrency Assets Pricing

Angelo and Salzer (2020) divide cryptographic tokens into two types by its security features: security token and utility token.[1] Similar to a conventional equity, Security token provides user an ownership over the protocol and proceeds of which the protocol earns. The non-security Utility token, in contrast, does not provide ownership and cash flow to its holder. It is used as a mean of exchange and payment for transactions, products and services made on the network, as well as to redeem for a product and service that the platform founder promised when they raised the fund through ICO.

From investor's perspective, utility tokens are held as investor expects the protocol to be widely adopted in the future, leading to a greater demand for the token and consequently yield some price appreciation and capital gain to the investor as a reward.

By this nature, Cong, Li et al. (2021) find that the equilibrium token price is driven by an aggregate heterogeneous users' transactional demand, rather than the discounted cash flow approach which is usually done with conventional investment securities. Protocol's

[1] Many sources mention the third type of cryptographic tokens as a governance token as a hybrid type of security token and utility token; users can spend the token as a payment for a transaction and own right over the protocol or applications built atop of the protocol without earning cash flow.

user adoption now takes part as another determinant of equilibrium price. As the protocol becomes attractive and the user base becomes larger, it is easier for ones to find a counterparty to transact, and the token becomes more useful. (Gryglewicz, Mayer et al. 2021)

Announcement Effects in Cryptocurrency Market and Market Efficiency

Numbers of prior literature suggest mixed evidence of crypto market's reaction to announcement. Events may include positive news e.g., government's acceptance of cryptocurrencies, listing on exchange, strategic partnership, or negative news e.g., hacking, restrictive regulatory change, etc. Hashemi Joo, Nishikawa et al. (2020) observe a large abnormal return on the event day (Day 0) in three primary cryptocurrencies: Bitcoin, Ethereum and Ripple. They also suggest that the market absorbs the information apparently slowly, up to six days. Moreover, average CAR is larger for negative news than positive news. Similar results are found by Yue, Zhang et al. (2021), who investigate five positive news and five negative news and suggest that positive daily average return of 5 and 100 largest cryptocurrencies occurs during (-4,+20) window for the positive news and negative daily return occurs during (-2,+5) window for the negative news.

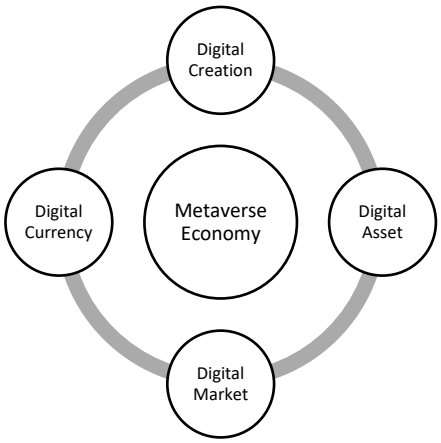
Other interesting findings include Brown and Douglass (2020) who discover increase in cryptocurrency price following thefts, Azouzi and Echchabi (2019) who find Bitcoin price has no reaction regarding Facebook's announcement of Libra project, Zhang and Gregoriou (2020) who observe a significant but temporary price drop in 100 largest cryptocurrencies after Chinese government's ICO ban in 2017, Ante (2021) who find a significant increase in Dodge's price following Elon Musk's tweets, but insignificant for Bitcoin.

These studies are linked to the Efficient Market Theorem. Handful literatures indicate that efficiency level varies to liquidity and volatility; (Wei 2018) Nascent tokens are typically illiquid and highly volatile, therefore are inefficient. (Al-Yahyaee, Mensi et al. 2020) Degree of efficiency is also cyclical. (Al-Yahyaee, Mensi et al. 2020, Zhang, Chan et al. 2020, Noda 2021) Zhang, Chan et al. (2020) show that when the market is bullish, hourly returns of Bitcoin, Ethereum, and Litecoin exhibit a random walk, which indicates market efficiency, while the market shows persistence positive autocorrelation, which indicates market inefficiency during bearish state. Noda (2021) adds that Bitcoin has stronger degree of efficiency than Ethereum in most of observed period, which could result from different trading volumes, market capitalization, and percentage of total market capitalization.

Alam (2017) points that the sensitivity of cryptocurrency price to an information flow can be explained by its nature of having no intrinsic value per se. The information, therefore, has a direct impact on market demand and supply. Unlike a conventional equity the price of which is driven either by its operation and the backed commodity, this makes it more difficult for the market to incorporate the information into the stock value.

Metaverse Ecosystem and Tokens Return

Limited economic literatures study on Metaverse-categorized tokens. Ynag, Zhao et al. (2022) pose four fundamental elements of metaverse economy:



Digital Creation: Similar to real world's industrial sector, creators (manufacturers) require tools, equipment and facilities to product goods.

Figure 2 Fundamental components of metaverse

Digital Assets: Proof of ownership over a unique digital asset or a monetary value

Digital Market: A place, as well as an infrastructure, for users to trade for incomes

Digital Currency: A medium of exchange in metaverse

From a perspective view, one economy is expected to be interoperable with other metaverse economy to allow users to trade virtual items across platforms.

Another relevant literature is (Vidal-Tomás 2022). He describes one distinct advantage of token-based play-to-earn platform as allowing non-gamer investors to invest in the platform without need to play the game themselves. He examines the abnormal return of play-to-earn, metaverse, and play-to-earn metaverse tokens and finds that there exists an abnormal return of these tokens over the market capitalization-weighted benchmark, CCi30, on average, both in short run and long run. However, the outperformance remains inconclusive as these types of tokens also bear much higher volatility and heterogeneity.

VC-backed IPO and Long-run Return

During the early stages of the business, venture capital (VC) is a promising source of funds for young firms that have insufficient cash flow. Cumming and Johan (2008) observe that as VCs are expert in due diligence, strategic advisory, and networking, and asymmetric information problem is mitigated, they are more likely to exit successfully.

Several literatures investigate performance of the stocks of the company that are backed by VC. Mixed results are found across countries and regions. Ritter (2016) finds VC-backed US firms give higher average first-day return and average 3-year buy-and-hold return then non-VC-backed firms. Bessler and Seim (2012) finds VC-backed in Europe generate positive abnormal return to investors. Ivanov and Xie (2010) finds evidence that startups that are backed by a corporate venture capitalist (CVC) have higher valuation when they go public if and only if they have a strategic-overlap with their parent.

On the contrary, Kirkulak (2008) finds VC-backed IPO high initial returns but significantly underperform non-VC-backed IPO in long run. da Silva Rosa, Velayuthen et al. (2003) finds indifferent normal returns for Australian VC-backed and non-VC-backed IPO.

Considering findings from literatures above, we developed the following hypothesis:

H_1: There exists a positive abnormal return in metaverse tokens following Facebook's announcement.

H_2: Gamefi tokens have larger CAR than non-gamefi tokens.

H_3: Protocols with marketplace have lager CAR than those without.

H_4: VC-backed metaverse tokens earns larger abnormal return than non-VC-backed tokens.

REFERENCES

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Appendix

Metaverse

The terms metaverse was initially introduced in a 1992 sci-fi novel 'Snow Crash' by Neal Stephenson, as a combination of 'meta' (beyond, surreal) and 'verse' (world). Nowadays, it is commonly percept as a virtual environment that provides an immersive experience to the users. Lee, Braud et al. (2021) divided the development to the ideal 'metaverse' into three consecutive phases as follows.

1. Digital twins: a digital clone of oneself that replicates all personalities and action taken in a physical world, in a digitalized real world
2. Digital Natives: a virtual environment which may differ from the physical world. In this setting, one's digital clone may not necessarily duplicate the physical self yet may behave differently according to a different context and situation. However, the characteristics and decision-making process is still based on the original, physical self. The action taken in each virtual world has no effect across each world as well as the physical world.
3. Co-existence of physical-virtual reality: A virtual environment where ones can seamlessly act and sense across physical and virtual world and switch their presence interchangeably. The effect of decision making, and action takes place in both worlds in real time. Interoperability allows ones to go across each virtual environment.

One challenge of the current development to the metaverse is a zero-latency, meaning that users can sense and experience the situation between two worlds without frictions. Ideally, scientists expect a maximum 1 millisecond (ms) latency to allow users to perceive indifferently between by their physical self and by their digital self (that consequently affects the physical self and vice versa). Nevertheless, present network and device ability may not yet cross the border. For instance, it takes 19 ms for a typical smartphone to display the image obtained from the camera lens on the screen. Moreover, the current speed of 4G and G5 is not enough for delivering the content in real time. Several other technological constraints such as scalability problem, which a requirement of computational resource increases with algorithmic complexity, as well as many XR devices and volumetric displays are still too large to be portable and too costly to be widely used in a massive scale.

Without doubt, metaverse grows along with technological advance. Apart from technological issue, several problems such as ethical dilemma, regulations, virtual world governance also exist. The advent of the blockchain technology and cryptocurrency is one of the keys that make the metaverse closer to reality.

Blockchain Technology and Cryptocurrency

People have attempted to introduce a digital money for over decades, however, all failed due to one crucial issue, the double-spending problem. The problem arises when one unit of currency can be spent more than once, which leads to a heavy dependence on an intermediary, i.e., banks, as a certificate authority to prove that one's value has been transferred and settled only once. As

a compensation for the task, extra cost, i.e., transaction fees are paid to those intermediaries at user's expense. Reliance on a middleman also incurs trust issue, which ones must believe that the intermediaries are acting fairly for of their benefit, as well as a centralized database is prone to be attacked as the attackers are aware where the data are solely kept.

In 2008, an anonymous inventor Satoshi Nagamoto proposed in his paper, Bitcoin: A Peer-to-Peer Electronic Cash System. He suggests a distributed ledger system called Blockchain as a solution to the double-spending problem. By this concept, each transaction is announced throughout the network consisting of numbers of node, a computation unit owned by individuals or organizations. Each node includes a line of transactional message in to a 'block', which is encrypted through a hash function, and puts its best computational effort to solve the hash function, finding a random value 'nonce' that equates the function to the unique value call 'hash'. This procedure is called Proof-of-Work.

The first winning node will announce the nonce and the rest of nodes accept that block into its record. Each single block is chained by having a hash of the previous block as a part of it, meaning that a slight change in one line of transaction inside a block, says someone is maliciously trying to falsify the transferred amount, will result in a change in the entire hash and conflict with the original harsh contained in the succeeding block. In this case, the falsified block will be rejected by the consensus and become invalid.

The ledger being recorded by the public becomes what is so-called 'trustless system' where the reliance on the intermediary is eliminated. The

bitcoin's cryptographic currency was later extended by a Russian inventor Vitalik Buterin, who introduced the Ethereum protocol with a second layer namely Smart Contract, which is a programmed code that is executed automatically once a predetermined condition(s) is/are met.

The smart contract feature allows developers to develop numerous applications and can even create their own currency called 'token' on top of the Ethereum chain, which brings a large chunk of users and nodes to participate, stronger network magnifies even larger user base and causes a large demand for its native currency Ether (ETH) as a mean of payment for the transactions. Without doubt, Ether consequently became the second most popular cryptocurrency following the Bitcoin.

Adaptation of Blockchain and Cryptocurrency in the Metaverse

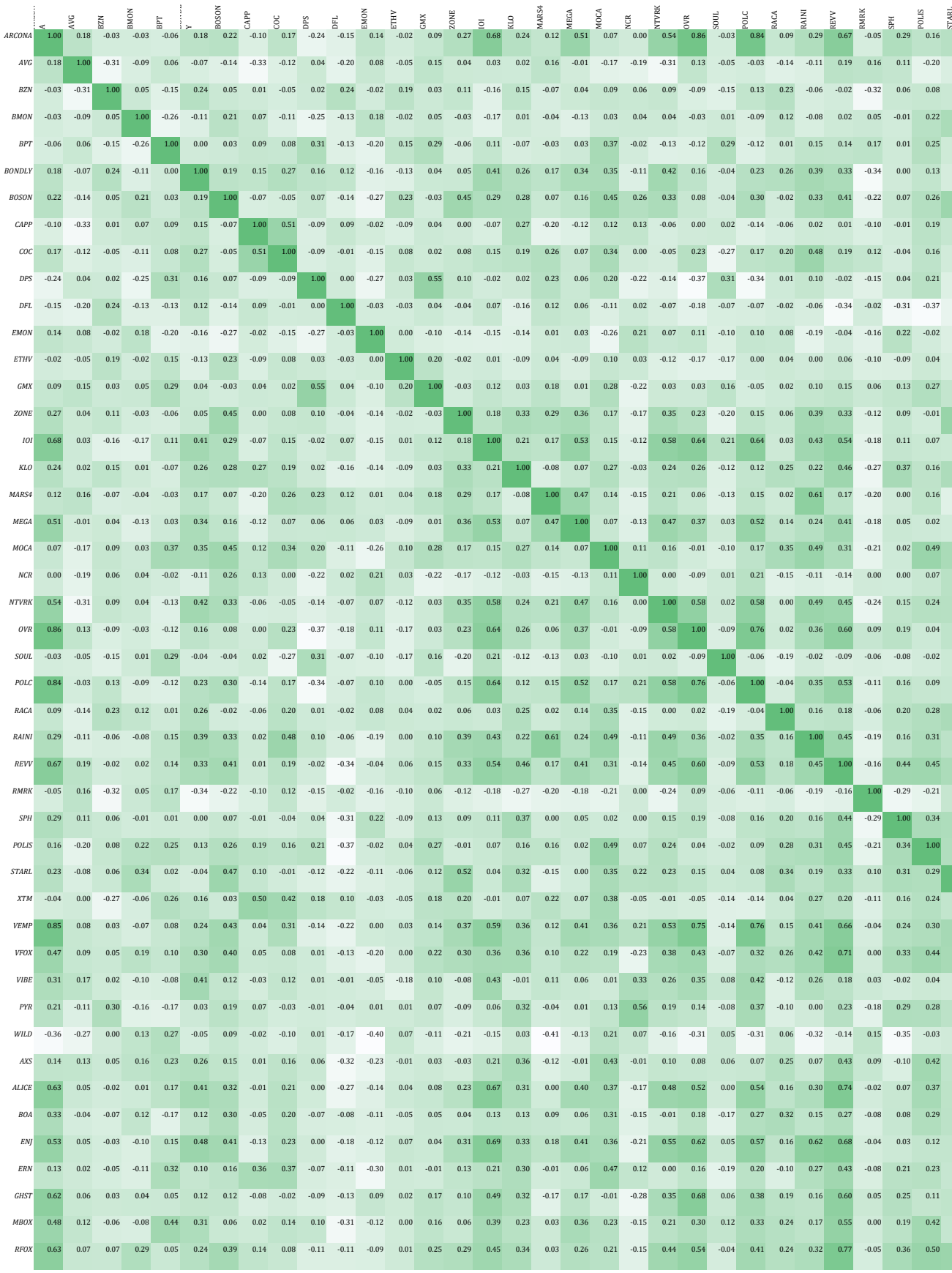
Existence of cryptographic tokens can advocate the economy in the metaverse and make it closer to the real world's economy. It is worth mentioning that there are two types of a cryptographic token. Firstly, fungible token is a token each of which can be substituted with another. Those cryptocurrencies we discussed above are also considered this type of token and, indeed, can be a medium of exchange in the metaverse instead of fiat money. In contrary to another type, a Non-Fungible Token (NFT), each of which is unique and cannot be substituted by any other. A typical use of NTF is as a proof of ownership over certain digital assets e.g., art and collectibles. This feature is also adopted in metaverse. For instance, Decentraland allows users to purchase a virtual real

estate (NTF) by its token MANA. Enjin Coin allows players to purchase a collectible item in a game.

Not limited to only ownership of assets, blockchain also helps alleviate several metaverse-related issues. Jeon, Youn et al. (2021) suggests minting one's avatar, a digital clone of real person in a physical world, as an NFT can assure uniqueness and prevent criminal to impersonate and take an unlawful action on one's behalf.

Correlation Matrix of Daily Returns

See Table 1



	A	AVG	BZN	BMON	BPT	Y	BOSON	CAPP	COC	DPS	DFL	EMON	ETHV	GMX	ZONE	IOI	KLO	MARS4	MEGA	MOCA	NCR	NTVRK	OVR	SOUL	POLC	RACA	RAINI	REVV	RMRK	SPH	POLIS	STARL
ARCONA	1.00	0.18	-0.03	-0.03	-0.06	0.18	0.22	-0.10	0.17	-0.24	-0.15	0.14	-0.02	0.09	0.27	0.68	0.24	0.12	0.51	0.07	0.00	0.54	0.86	-0.03	0.84	0.09	0.29	0.67	-0.05	0.29	0.16	
AVG	0.18	1.00	-0.31	-0.09	0.06	-0.07	-0.14	-0.33	-0.12	0.04	-0.20	0.08	-0.05	0.15	0.04	0.03	0.02	0.16	-0.01	-0.17	-0.19	-0.31	0.13	-0.05	-0.03	-0.14	-0.11	0.19	0.16	0.11	-0.20	
BZN	-0.03	-0.31	1.00	0.05	-0.15	0.24	0.05	0.01	-0.05	0.02	0.24	-0.02	0.19	0.03	0.11	-0.16	0.15	-0.07	0.04	0.09	0.06	0.09	-0.09	-0.15	0.13	0.23	-0.06	-0.02	-0.32	0.06	0.08	
BMON	-0.03	-0.09	0.05	1.00	-0.26	-0.11	0.21	0.07	-0.11	-0.25	-0.13	0.18	-0.02	0.05	-0.03	-0.17	0.01	-0.04	-0.13	0.03	0.04	0.04	-0.03	0.01	-0.09	0.12	-0.08	0.02	0.05	-0.01	0.22	
BPT	-0.06	0.06	-0.15	-0.26	1.00	0.00	0.03	0.09	0.08	0.31	-0.13	-0.20	0.15	0.29	-0.06	0.11	-0.07	-0.03	0.03	0.37	-0.02	-0.13	-0.12	0.29	-0.12	0.01	0.15	0.14	0.17	0.01	0.25	
BONDLY	0.18	-0.07	0.24	-0.11	0.00	1.00	0.19	0.15	0.27	0.16	0.12	-0.16	-0.13	0.04	0.05	0.41	0.26	0.17	0.34	0.35	-0.11	0.42	0.16	-0.04	0.23	0.26	0.39	0.33	-0.34	0.00	0.13	
BOSON	0.22	-0.14	0.05	0.21	0.03	0.19	1.00	-0.07	-0.05	0.07	-0.14	-0.27	0.23	-0.03	0.45	0.29	0.28	0.07	0.16	0.45	0.26	0.33	0.08	-0.04	0.30	-0.02	0.33	0.41	-0.22	0.07	0.26	
CAPP	-0.10	-0.33	0.01	0.07	0.09	0.15	-0.07	1.00	0.51	-0.09	0.09	-0.02	-0.09	0.04	0.00	-0.07	0.27	-0.20	-0.12	0.12	0.13	-0.06	0.00	0.02	-0.14	-0.06	0.02	0.01	-0.10	-0.01	0.19	
COC	0.17	-0.12	-0.05	-0.11	0.08	0.27	-0.05	0.51	1.00	-0.09	-0.01	-0.15	0.08	0.02	0.08	0.15	0.19	0.26	0.07	0.34	0.00	-0.05	0.23	-0.27	0.17	0.20	0.48	0.19	0.12	-0.04	0.16	
DPS	-0.24	0.04	0.02	-0.25	0.31	0.16	0.07	-0.09	-0.09	1.00	0.00	-0.27	0.03	0.55	0.10	-0.02	0.02	0.23	0.06	0.20	-0.22	-0.14	-0.37	0.31	-0.34	0.01	0.10	-0.02	-0.15	0.04	0.21	
DFL	-0.15	-0.20	0.24	-0.13	-0.13	0.12	-0.14	0.09	-0.01	0.00	1.00	-0.03	-0.03	0.04	-0.04	0.07	-0.16	0.12	0.06	-0.11	0.02	-0.07	-0.18	-0.07	-0.07	-0.02	-0.06	-0.34	-0.02	-0.31	-0.37	
EMON	0.14	0.08	-0.02	0.18	-0.20	-0.16	-0.27	-0.02	-0.15	-0.27	-0.03	1.00	0.00	-0.10	-0.14	-0.15	-0.14	0.01	0.03	-0.26	0.21	0.07	0.11	-0.10	0.10	0.08	-0.19	-0.04	-0.16	0.22	-0.02	
ETHV	-0.02	-0.05	0.19	-0.02	0.15	-0.13	0.23	-0.09	0.08	0.03	-0.03	0.00	1.00	0.20	-0.02	0.01	-0.09	0.04	-0.09	0.10	0.03	-0.12	-0.17	-0.17	0.00	0.04	0.00	0.06	-0.10	-0.09	0.04	
GMX	0.09	0.15	0.03	0.05	0.29	0.04	-0.03	0.04	0.02	0.55	0.04	-0.10	0.20	1.00	-0.03	0.12	0.03	0.18	0.01	0.28	-0.22	0.03	0.03	0.16	-0.05	0.02	0.10	0.15	0.06	0.13	0.27	
ZONE	0.27	0.04	0.11	-0.03	-0.06	0.05	0.45	0.00	0.08	0.10	-0.04	-0.14	-0.02	-0.03	1.00	0.18	0.33	0.29	0.36	0.17	-0.17	0.35	0.23	-0.20	0.15	0.06	0.39	0.33	-0.12	0.09	-0.01	
IOI	0.68	0.03	-0.16	-0.17	0.11	0.41	0.29	-0.07	0.15	-0.02	0.07	-0.15	0.01	0.12	0.18	1.00	0.21	0.17	0.53	0.15	-0.12	0.58	0.64	0.21	0.64	0.03	0.43	0.54	-0.18	0.11	0.07	
KLO	0.24	0.02	0.15	0.01	-0.07	0.26	0.28	0.27	0.19	0.02	-0.16	-0.14	-0.09	0.03	0.33	0.21	1.00	-0.08	0.07	0.27	-0.03	0.24	0.26	-0.12	0.12	0.25	0.22	0.46	-0.27	0.37	0.16	
MARS4	0.12	0.16	-0.07	-0.04	-0.03	0.17	0.07	-0.20	0.26	0.23	0.12	0.01	0.04	0.18	0.29	0.17	-0.08	1.00	0.47	0.14	-0.15	0.21	0.06	-0.13	0.15	0.02	0.61	0.17	-0.20	0.00	0.16	
MEGA	0.51	-0.01	0.04	-0.13	0.03	0.34	0.16	-0.12	0.07	0.06	0.06	0.03	-0.09	0.01	0.36	0.53	0.07	0.47	1.00	0.07	-0.13	0.47	0.37	0.03	0.52	0.14	0.24	0.41	-0.18	0.05	0.02	
MOCA	0.07	-0.17	0.09	0.03	0.37	0.35	0.45	0.12	0.34	0.20	-0.11	-0.26	0.10	0.28	0.17	0.15	0.27	0.14	0.07	1.00	0.11	0.16	-0.01	-0.10	0.17	0.35	0.49	0.31	-0.21	0.02	0.49	
NCR	0.00	-0.19	0.06	0.04	-0.02	-0.11	0.26	0.13	0.00	-0.22	0.02	0.21	0.03	-0.22	-0.17	-0.12	-0.03	-0.15	-0.13	0.11	1.00	0.00	-0.09	0.01	0.21	-0.15	-0.11	-0.14	0.00	0.00	0.07	
NTVRK	0.54	-0.31	0.09	0.04	-0.13	0.42	0.33	-0.06	-0.05	-0.14	-0.07	0.07	-0.12	0.03	0.35	0.58	0.24	0.21	0.47	0.16	0.00	1.00	0.58	0.02	0.58	0.00	0.49	0.45	-0.24	0.15	0.24	
OVR	0.86	0.13	-0.09	-0.03	-0.12	0.16	0.08	0.00	0.23	-0.37	-0.18	0.11	-0.17	0.03	0.23	0.64	0.26	0.06	0.37	-0.01	-0.09	0.58	1.00	-0.09	0.76	0.02	0.36	0.60	0.09	0.19	0.04	
SOUL	-0.03	-0.05	-0.15	0.01	0.29	-0.04	-0.04	0.02	-0.27	0.31	-0.07	-0.10	-0.17	0.16	-0.20	0.21	-0.12	-0.13	0.03	-0.10	0.01	0.02	-0.09	1.00	-0.06	-0.19	-0.02	-0.09	-0.06	-0.08	-0.02	
POLC	0.84	-0.03	0.13	-0.09	-0.12	0.23	0.30	-0.14	0.17	-0.34	-0.07	0.10	0.00	-0.05	0.15	0.64	0.12	0.15	0.52	0.17	0.21	0.58	0.76	-0.06	1.00	-0.04	0.35	0.53	-0.11	0.16	0.09	
RACA	0.09	-0.14	0.23	0.12	0.01	0.26	-0.02	-0.06	0.20	0.01	-0.02	0.08	0.04	0.02	0.06	0.03	0.25	0.02	0.14	0.35	-0.15	0.00	0.02	-0.19	-0.04	1.00	0.16	0.18	-0.06	0.20	0.28	
RAINI	0.29	-0.11	-0.06	-0.08	0.15	0.39	0.33	0.02	0.48	0.10	-0.06	-0.19	0.00	0.10	0.39	0.43	0.22	0.61	0.24	0.49	-0.11	0.49	0.36	-0.02	0.35	0.16	1.00	0.45	-0.19	0.16	0.31	
REVV	0.67	0.19	-0.02	0.02	0.14	0.33	0.41	0.01	0.19	-0.02	-0.34	-0.04	0.06	0.15	0.33	0.54	0.46	0.17	0.41	0.31	-0.14	0.45	0.60	-0.09	0.53	0.18	0.45	1.00	-0.16	0.44	0.45	
RMRK	-0.05	0.16	-0.32	0.05	0.17	-0.34	-0.22	-0.10	0.12	-0.15	-0.02	-0.16	-0.10	0.06	-0.12	-0.18	-0.27	-0.20	-0.18	-0.21	0.00	-0.24	0.09	-0.06	-0.11	-0.06	-0.19	-0.16	1.00	-0.29	-0.21	
SPH	0.29	0.11	0.06	-0.01	0.01	0.00	0.07	-0.01	-0.04	0.04	-0.31	0.22	-0.09	0.13	0.09	0.11	0.37	0.00	0.05	0.02	0.00	0.15	0.19	-0.08	0.16	0.20	0.16	0.44	-0.29	1.00	0.34	
POLIS	0.16	-0.20	0.08	0.22	0.25	0.13	0.26	0.19	0.16	0.21	-0.37	-0.02	0.04	0.27	-0.01	0.07	0.16	0.16	0.02	0.49	0.07	0.24	0.04	-0.02	0.09	0.28	0.31	0.45	-0.21	0.34	1.00	
STARL	0.23	-0.08	0.06	0.34	0.02	-0.04	0.47	0.10	-0.01	-0.12	-0.22	-0.11	-0.06	0.12	0.52	0.04	0.32	-0.15	0.00	0.35	0.22	0.23	0.15	0.04	0.08	0.34	0.19	0.33	0.10	0.31	0.29	
XTM	-0.04	0.00	-0.27	-0.06	0.26	0.16	0.03	0.50	0.42	0.18	0.10	-0.03	-0.05	0.18	0.20	-0.01	0.07	0.22	0.07	0.38	-0.05	-0.01	-0.05	-0.14	-0.14	0.04	0.27	0.20	-0.11	0.16	0.24	
VEMP	0.85	0.08	0.03	-0.07	0.08	0.24	0.43	0.04	0.31	-0.14	-0.22	0.00	0.03	0.14	0.37	0.59	0.36	0.12	0.41	0.36	0.21	0.53	0.75	-0.14	0.76	0.15	0.41	0.66	-0.04	0.24	0.30	
VFOX	0.47	0.09	0.05	0.19	0.10	0.30	0.40	0.05	0.08	0.01	-0.13	-0.20	0.00	0.22	0.30	0.36	0.36	0.10	0.22	0.19	-0.23	0.38	0.43	-0.07	0.32	0.26	0.42	0.71	0.00	0.33	0.44	
VIBE	0.31	0.17	0.02	-0.10	-0.08	0.41	0.12	-0.03	0.12	0.01	-0.01	-0.05	-0.18	0.10	-0.08	0.43	-0.01	0.11	0.06	0.01	0.33	0.26	0.35	0.08	0.42	-0.12	0.26	0.18	0.03	-0.02	0.04	
PYR	0.21	-0.11	0.30	-0.16	-0.17	0.03	0.19	0.07	-0.03	-0.01	-0.04	0.01	0.01	0.07	-0.09	0.06	0.32	-0.04	0.01	0.13	0.56	0.19	0.14	-0.08	0.37	-0.10	0.00	0.23	-0.18	0.29	0.28	
WILD	-0.36	-0.27	0.00	0.13	0.27	-0.05	0.09	-0.02	-0.10	0.01	-0.17	-0.40	0.07	-0.11	-0.21	-0.15	0.03	-0.41	-0.13	0.21	0.07	-0.16	-0.31	0.05	-0.31	0.06	-0.32	-0.14	0.15	-0.35	-0.03	
AXS	0.14	0.13	0.05	0.16	0.23	0.26	0.15	0.01	0.16	0.06	-0.32	-0.23	-0.01	0.03	-0.03	0.21	0.36	-0.12	-0.01	0.43	-0.01	0.10	0.08	0.06	0.07	0.25	0.07	0.43	0.09	-0.10	0.42	
ALICE	0.63	0.05	-0.02	0.01	0.17	0.41	0.32	-0.01	0.21	0.00	-0.27	-0.14	0.04	0.08	0.23	0.67	0.31	0.00	0.40	0.37	-0.17	0.48	0.52	0.00	0.54	0.16	0.30	0.74	-0.02	0.07	0.37	
BOA	0.33	-0.04	-0.07	0.12	-0.17	0.12	0.30	-0.05	0.20	-0.07	-0.08	-0.11	-0.05	0.05	0.04	0.13	0.13	0.09	0.06	0.31	-0.15	-0.01	0.18	-0.17	0.27	0.32	0.15	0.27	-0.08	0.08	0.29	
ENJ	0.53	0.05	-0.03	-0.10	0.15	0.48	0.41	-0.13	0.23	0.00	-0.18	-0.12	0.07	0.04	0.31	0.69	0.33	0.18	0.41	0.36	-0.21	0.55	0.62	0.05	0.57	0.16	0.62	0.68	-0.04	0.03	0.12	
ERN	0.13	0.02	-0.05	-0.11	0.32	0.10	0.16	0.36	0.37	-0.07	-0.11	-0.30	0.01	-0.01	0.13	0.21	0.30	-0.01	0.06	0.47	0.12	0.00	0.16	-0.19	0.20	-0.10	0.27	0.43	-0.08	0.21	0.23	
GHST	0.62	0.06	0.03	0.04	0.05	0.12	0.12	-0.08	-0.02	-0.09	-0.13	0.09	0.02	0.17	0.10	0.49	0.32	-0.17	0.17	-0.01	-0.28	0.35	0.68	0.06	0.38	0.19	0.16	0.60	0.05	0.25	0.11	
MBOX	0.48	0.12	-0.06	-0.08	0.44	0.31	0.06	0.02	0.14	0.10	-0.31	-0.12	0.00	0.16	0.06	0.39	0.23	0.03	0.36	0.23	-0.15	0.21	0.30	0.12	0.33	0.24	0.17	0.55	0.00	0.19	0.42	
RFOX	0.63	0.07	0.07	0.29	0.05	0.24	0.39	0.14	0.08	-0.11	-0.11	-0.09	0.01	0.25	0.29	0.45	0.34	0.03	0.26	0.21	-0.15	0.44	0.54	-0.04	0.41	0.24	0.32	0.77	-0.05	0.36	0.50	

RNDR	0.05	-0.02	0.21	-0.06	0.11	0.22	0.15	0.06	0.48	-0.25	0.14	-0.22	0.12	-0.02	0.08	0.13	0.02	0.24	-0.14	0.30	0.08	0.09	0.19	-0.21	0.22	0.14	0.56	0.01	0.15	-0.08	0.00
SENSO	0.58	-0.08	-0.07	0.06	0.14	0.18	0.29	-0.01	0.01	-0.08	0.03	0.01	-0.03	0.14	0.21	0.52	0.23	0.08	0.38	0.28	-0.08	0.40	0.47	0.10	0.46	0.15	0.34	0.60	-0.16	0.22	0.18
YGG	0.52	0.06	0.12	0.06	0.29	0.40	0.47	-0.02	0.19	0.04	-0.24	-0.20	0.13	0.06	0.13	0.51	0.25	-0.02	0.32	0.47	-0.06	0.29	0.37	0.02	0.49	0.17	0.28	0.68	-0.08	0.07	0.44
BTC	0.03	-0.13	-0.01	0.07	0.13	0.31	0.50	-0.02	0.11	0.10	0.03	-0.09	0.15	-0.02	-0.07	0.13	0.20	0.08	-0.04	0.62	0.11	0.14	-0.14	-0.03	0.11	0.19	0.35	0.29	-0.25	0.02	0.54
ETH	0.04	-0.08	0.10	0.04	0.35	0.42	0.59	0.07	0.25	0.30	-0.09	-0.34	0.19	0.25	0.18	0.19	0.30	0.21	0.10	0.85	0.09	0.16	-0.05	-0.06	0.15	0.25	0.55	0.49	-0.22	0.05	0.56
BNB	0.13	0.17	-0.20	0.05	0.36	0.22	0.07	-0.03	-0.03	0.23	0.22	0.13	-0.23	0.31	-0.02	0.16	-0.12	0.14	0.02	0.42	-0.07	0.02	0.06	0.12	0.07	0.03	0.24	0.12	-0.07	-0.14	0.21
ADA	-0.06	-0.26	0.13	-0.07	0.23	0.56	0.39	0.39	0.32	0.29	0.14	-0.36	0.00	0.16	0.06	0.17	0.32	0.00	0.08	0.60	0.19	0.10	-0.16	-0.08	0.02	0.31	0.28	0.29	-0.12	0.00	0.48
XRP	0.04	-0.35	0.05	0.02	0.23	0.41	0.36	0.32	0.28	0.18	0.09	-0.27	0.09	0.01	0.03	0.23	0.31	-0.04	0.04	0.55	0.30	0.15	-0.09	0.09	0.15	0.34	0.35	0.25	-0.08	-0.01	0.45
SOL	-0.05	0.14	0.12	-0.06	0.19	0.50	0.31	0.34	0.35	0.24	-0.28	-0.15	-0.02	0.03	0.18	-0.03	0.30	0.15	0.02	0.43	0.16	-0.04	-0.11	-0.11	0.00	0.25	0.29	0.35	-0.20	0.05	0.42
DOT	0.01	-0.20	0.04	-0.05	0.14	0.58	0.18	0.11	0.21	0.36	0.14	-0.30	-0.05	0.23	0.03	0.18	0.12	0.34	0.20	0.43	-0.11	0.30	-0.05	-0.06	0.01	0.20	0.40	0.32	-0.11	-0.02	0.48
TRX	0.25	-0.22	0.04	-0.09	0.26	0.53	0.44	0.01	0.31	0.26	0.00	-0.23	0.04	0.11	0.12	0.44	0.25	0.15	0.20	0.63	0.11	0.34	0.11	0.02	0.35	0.42	0.58	0.42	-0.09	0.13	0.49
AVAX	-0.08	-0.24	0.18	-0.26	0.28	0.40	0.16	0.50	0.44	0.38	0.05	-0.29	-0.12	0.12	0.15	0.03	0.21	0.12	0.18	0.37	0.21	-0.03	-0.10	0.06	0.03	0.18	0.29	0.23	-0.06	0.01	0.31
MATIC	-0.26	-0.05	-0.18	0.07	0.24	0.16	0.45	0.12	0.10	0.16	-0.08	-0.13	0.08	0.14	0.02	-0.13	0.15	0.11	-0.10	0.52	0.26	-0.11	-0.26	-0.07	-0.13	0.22	0.20	0.06	0.09	-0.19	0.24

Table 1 Correlation Matrix of Daily Returns, benchmark cryptocurrencies highlighted in grey, several metaverse tokens show a strong relationship with benchmark cryptocurrencies.

Data Used in the Analysis

TOKEN	Pre-announce Average Return	CAR	GAME FI	MK PLACE	HOLDER	HOLDER _RANK	ILLIQ	ILLIQ _RANK	VC
ALICE	0.0091	0.1600	1	1	6,030	3	0.00000000	1	21.00%
ARCONA	-0.0009	4.7200	0	0	23,103	4	0.00004033	5	7.00%
AVG	-0.0230	0.3520	1	0	3,093	2	0.00000001	2	8.26%
AXS	0.0283	-0.1080	1	1	52,657	5	0.00000000	1	4.00%
BMON	-0.0087	0.3200	1	1	74,922	5	0.00000006	2	44.00%
BOA	0.0268	0.4530	0	0	1,211	1	0.00000020	3	11.50%
BONDLY	-0.0021	0.0044	0	1	23,613	5	0.00000544	4	3.00%
BOSON	0.0268	0.2330	0	1	5,645	3	0.00000002	2	5.00%
BPT	0.0364	-0.1210	0	0	3,517	3	0.00000008	3	0.00%
BZN	0.0954	-0.7730	1	1	1	1	0.00000006	2	5.00%
CAPP	0.0191	1.6000	0	0	13,350	4	0.00009264	5	0.00%
COC	0.0141	1.2600	1	1	1,992	2	0.00000038	4	0.00%
DFL	-0.0058	-0.0240	1	1	1,489	1	0.00000034	4	21.00%
DPS	0.0841	-0.7890	1	1	12,734	4	0.00002900	5	10.00%
EMON	-0.0025	0.3100	1	0	1,299	1	0.00000791	4	15.00%
ENJ	0.0155	0.3110	1	1	174,009	5	0.00000000	1	10.00%
ERN	0.0064	0.3760	0	1	28,082	5	0.00000000	1	8.00%
ETHV	0.0087	-0.0671	1	1	2,599	2	0.00000000	1	12.50%
GHST	0.0073	0.1080	1	0	7,281	3	0.00000000	1	0.00%
GMX	-0.0077	0.2180	1	0	8,397	4	0.00820600	5	0.00%
IOI	-0.0003	0.4180	1	1	1,517	1	0.00000005	2	13.33%
KLO	0.0288	0.4440	0	1	6,696	3	0.00000008	3	8.00%
MARS4	-0.0040	1.4200	1	1	388	1	0.00003150	5	25.00%
MBOX	0.0035	0.0320	1	1	213,440	5	0.00000000	1	8.00%
MEGA	0.0299	0.4230	1	0	905	1	0.00000004	2	0.00%
MOCA	0.0015	0.0448	0	1			0.00000026		8.00%

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NCR	0.0034	0.6140	0	1	5,401	3	0.00003666	5	0.00%
NTVRK	0.0246	0.7870	1	0	8,593	4	0.00000002	2	13.00%
OVR	0.0012	1.1800	0	1	17,336	4	0.00000005	2	3.88%
POLC	0.0362	2.7400	0	1	26,422	5	0.00000032	3	1.00%
POLIS	0.0029	0.1740	1	0	2,142	2	0.00008049	5	0.00%
PYR	0.0191	0.7760	1	0	6,897	3	0.00000000	1	2.63%
RACA	0.0778	-0.1730	1	1	456,974	5	0.00000324	4	4.64%
RAINI	-0.0074	0.9900	0	1	2,980	2	0.00000152	4	0.00%
REVV	0.0091	0.4130	1	1	8,460	4	0.00000019	3	10.00%
RFOX	0.0190	1.2200	0	0	9,391	4	0.00000115	4	0.00%
RMRK	0.0195	0.1130	0	0	4,600	3	0.00000000	1	0.00%
RNDR	0.0003	0.5160	0	0	13,331	4	0.00000001	2	0.80%
SAND	0.0094	1.6000	1	1	141,227	5	0.00000002	2	17.18%
SENSO	0.0250	0.4800	0	0	1,771	2	0.00000011	3	0.00%
SOUL	0.0076	-0.0720	0	1	160	1	32.47763355	5	0.00%
SPH	0.0100	0.5090	1	1	6,933	3	0.00000189	4	0.00%
STARL	0.0163	1.4700	1	1	33,576	5	0.00098037	5	0.00%
VEMP	0.0103	2.1000	0	0	3,404	2	0.00000033	3	3.10%
VFOX	0.0221	0.7140	0	0	2,836	2	0.00000219	4	0.00%
VIBE	0.0189	0.6870	0	1	6,591	3	0.00122695	5	10.00%
WILD	0.0389	-1.2900	0	1	2,634	2	0.00000017	3	11.50%
XTM	0.0081	0.5700	0	1	1,664	2	0.00000966	4	3.30%
YGG	0.0084	0.0751	1	1	16,127	4	0.00000000	1	25.00%
ZONE	0.0339	1.3900	0	0	896	1	0.00000283	4	3.50%

Table 2 Data used in the analysis

CausalImpact Result of Metaverse Tokens

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