METAVERSE AND METAVERSE CRYPTOCURRENCIES (META COINS): BUBBLES OR FUTURE?

Hilmi Tunahan Akkus[1], Samet Gursoy[2], Mesut Dogan[3], Ahmet Burak Demir[4]
[1]Balıkesir University, Savastepe Vocational School, Department of Wholesale and Retail, Balıkesir, Turkey.
 tunaakkus@balikesir.edu.tr , ORCID: 000-0002-8407-1580
[2]Burdur Mehmet Akif Ersoy University, Bucak ZTYO, Department of Customs Management, Burdur, Turkey.
 sametgursoy@mehmetakif.edu.tr , ORCID: 0000-0003-1020-7438
[3]Afyon Kocatepe University, Bayat Vocational School, Department of Business Administration, Afyon, Turkey.
 mesutdogan07@gmail.com , ORCID: 0000-0001-6879-1361
[4]Burdur Mehmet Akif Ersoy University, Institute of Social Sciences, Department of Customs Management, Burdur, Turkey.
 burakdemir@mit.tc , ORCID: 0000-0002-1597-7928

ABSTRACT

Purpose- Metaverse is one of the blockchain-based digital assets developed in recent years. The concept of metaverse refers to an alternative virtual universe in which individuals are represented by their avatars (virtual representation), they can create applications, socialize, buy and sell goods and services, and share. In addition, there are meta coins, i.e. local crypto coins, used in the metaverse. In this study, the concepts of metaverse and meta coin, which have become popular recently, are explained, and the existence of price bubbles in MANA, the meta coin of the Decentraland digital reality platform, which has the largest market value among meta coins, is investigated.
Methodology- The existence of price bubbles is investigated by the newly developed GSADF multiple bubble test.
Findings- According to the result of the analysis carried out with the GSADF test, the existence of price bubbles in MANA prices in different periods has been determined. Especially the bubbles that have formed in the recent period have been realized as a longer term. This situation shows the impression that significant speculative movements have occurred in the MANA token recently.
Conclusion- According to the findings, MANA prices are open to speculation. It is important for those investing or considering investing in MANA and other meta coins to consider the existence of bubbles in the respective token prices.

Keywords: Price bubbles, token, cryptocurrency, metaverse, meta coin.
JEL Codes: G11, G14, G15

1. INTRODUCTION

With the development of blockchain technology, new digital assets using blockchain technology have recently been developed. In addition to cryptocurrencies, especially Bitcoin, tokens, non-Fungible Tokens (NFTs), and the metaverse, whose popularity has increased rapidly after Facebook has changed its name to Meta, are blockchain-based digital assets developed in recent years. The interest in these assets is rapidly growing today, and the market value of the relevant digital assets is increasing in a similar way.

Metaverse is a concept created as a result of combining the words "meta", which means beyond and other, and "universe", which means the world. Although the word is translated directly as "beyond the universe, other universe, or another universe", metaverse is stated as "virtual universe, fictional universe, or online digital world" in literature and practice. The concept of metaverse is explained in detail in the second chapter.

Web 3.0, which we can call the last stage of the development of the internet, is another concept used together with the concept of Metaverse. In order to understand the metaverse phenomenon, it may also be useful to examine the developmental stages of the internet and the difference or change between these stages. Gonzalez (2021) describes the evolution of the web, which was invented in Switzerland by Tim Berners-Lee in the early 1990s, in three stages. Web 1.0 (Static Web) is the stage where the content on the Internet is predetermined, where people can make a website that they can browse, but cannot interact with it beyond leaving comments. Web 2.0 (Interactive Web) is the stage where people use

predetermined content, write small comments, and create content. Wikipedia, YouTube, WordPress, and Blogger are examples of the impact of the Web 2.0 stage on the world. Web 3.0 (Semantic Web) is the stage we are about to go through the Web 2.0 stage right now. Davies (2021) states that Web 3.0 refers to groups of projects supported by cryptocurrency, working together to create a decentralized internet services ecosystem, not any particular program. Web 3.0 draws attention to the internet architecture that allows users to do whatever they want without being dependent on any company or government. Stock and Blockchain NFT Academy (2022) states that Web 1.0 ranged from the 1990s to the early 2000s, and Web 2.0 is described as the period from the early 2000s to the present when large technology companies have controlled the most prominent online centers. Web 3.0, on the other hand, is the possible future version of the internet.

This study aims primarily to explain the concept of metaverse, meta coin, and meta coin markets, which have been popular very recently among blockchain-based digital assets. Additionally, it aims to investigate the existence of price bubbles MANA, the meta coin of the Decentraland digital reality platform, which has the largest market value among meta coins.

Price bubbles are price differences that cannot be explained by the fundamental value approach (Kıyılar and Akkaya, 2016: 231). The importance of price bubbles stems from the relationship between price bubbles and financial crises. Kıyılar and Akkaya (2016: 229) state that price bubbles play an important role in the formation of financial crises and that financial crises are triggered when price bubbles usually burst.

Information about the metaverse and metacoins is usually disclosed on news pages, news sites, or blogs. However, academic studies and empirical studies on the subject are very limited. It is thought that this study can contribute to the literature by explaining the concept of metaverse, which is very rare in the literature. In addition, revealing the existence of bubbles in the prices of MANA tokens used by the digital reality platform with the largest market value will be important for many stakeholders, especially investors. It is thought that this study will be the first in terms of investigating price bubbles in cryptocurrencies created for the metaverse. Although there have been many price bubble studies on cryptocurrencies to date, no studies investigating price bubbles in crypto coins have been found yet.

The sections after the introductory part of the study are as follows. In the second part of the study, the concepts of metaverse and meta coin are explained. In the third part of the study, literature explanations about price bubbles in cryptocurrencies are presented. In the fourth part, explanations about the method of the study are stated. In the fifth chapter, the data set and the findings obtained from the analyses are shared in tables. In the last part of the study, results and general evaluations are given.

2. METAVERSE AND METAVERSE CRYPTOCURRENCIES (META COINS)

In this section, the metaverse and metacoins, which have been revealed recently and whose full meaning and content are unknown by many, are explained in detail.

2.1. Concept of Metaverse

The concept of metaverse was first expressed in the science fiction writer Neal Stephenson's 1992 novel "Snow Crash", but the concept was previously defined as "cyberspace" in William Gibson's 1984 science fiction novel Neuromancer (evrimagaci.org, 2021).

As explained in the introduction, metaverse is a concept created as a result of combining the word "meta", which means beyond, other, or another, and "universe", which means the world or space. The word can be translated directly as "beyond the universe, other universe, another universe". However, there are more comprehensive and explanatory definitions of the metaverse in the literature. "The Metaverse can be defined as a multi-user real-time sandbox where individuals from all over the world can connect, live together, socialize and exchange value with each other through a network" (Corwen, 2021). The Metaverse is an alternate computer-generated world where people can share and interact as if they were in the real world. Today, the metaverse is a virtual space where people interact socially and economically using avatars (virtual representations) without experiencing real-world constraints such as time and distance. In this virtual world network, more people can interact by ignoring their cultural and language differences (Vernaza, Armuelles and Ruiz, 2012: 320-321). "The Metaverse is the post-reality universe, a perpetual and persistent multiuser environment merging physical reality with digital virtuality" (Mystakidis, 2022: 486).

Second Life, Fortnite, Minecraft, and Roblox are examples of cooperative and world-building games that incorporate metaverse features into their games. On these platforms, users can work in the virtual market, interact with others, participate in events and receive money for digital products and services (Clemens, 2022). Similarly, Clemens (2022) also explains that various versions of the metaverse have been produced by Hollywood through the non-existent fantasy universes used in movies such as Ready Player One, and Free Guy.

Virtual reality (virtual reality - VR) and augmented reality (AR) mentioned together with the metaverse are important technological tools that can be used in the creation of the metaverse concept.

2.2. Major Metaverse and Metaverse Coins

In every society and market in the metaverse world, different types of currencies are used, and shopping takes place in the same market (locally) with their own cryptocurrencies. As of December 2021, more than forty meta coins have been traded in the market.

First of all, clarifying the concepts of money and tokens in cryptocurrencies can make the subject easier to understand. Cryptocurrencies are divided into "coin" and "token". Cryptocurrencies that have a blockchain of their own are called coins, but those that are traded on an existing blockchain that has been developed before are called tokens. However, regardless of this difference, the expression of coin can also be used instead of tokens, a habit left over from Bitcoin (Güven and Şahinöz, 2018: 85). On the other hand, tokens are also divided into fungible and non-fungible tokens. In Table 1 below, the subject is tried to be illustrated by explaining the differences between these two concepts.

Table 1: Comparison of Fungible versus Non-fungible Tokens

Fungible Token	Non-fungible Token
E.g., 1 USD dollar	E.g., John Lennon Limited Edition Postage Stamps
Interchangeable	Not interchangeable
Uniform (all are the same)	Distinct or unique
Divisible	Indivisible

Source: The Sandbox Whitepaper, 2020: 8.

Cryptocurrency and metaverse are built on the same technology (ie. blockchain), so cryptocurrencies will be the most popular form of payment in the metaverse world. Cryptocurrencies would be the simplest, most convenient and cheapest method of exchanging a global metaverse (Laeeq, 2022). Many coins used in the metaverse universe are bought and sold. While some of these coins are much newer and not in demand, there are coins where commodities such as games and land-workplace are bought and sold. The following describes the three largest metaverse coins by market capitalization.

2.2.1. Decentraland Virtual Reality Platform Cryptocurrency: MANA

Decentraland is a digital real estate supported by the Ethereum blockchain, in which users or digital property owners can create applications, buy and sell goods and services, carry out other activities, and have a token called MANA for the realization of these activities (Ordano et al., 2017: 1). There are two digital assets on the Decentraland platform called LAND with non-fungible digital parcels and MANA, a fungible ERC-20[1] token that is burned to claim LAND and purchase in-world goods and services. (Ordano et al., 2017: 12). In this virtual reality platform, digital lands can be bought and sold in both the primary market and the secondary market.

2.2.2. Sandbox Virtual Reality Platform Cryptocurrency: SAND

The Sandbox metaverse is a play-to-earn (P2E) game built on the Ethereum blockchain. The Sandbox is a decentralized platform that allows gamers and creators to own a piece of the gaming virtual universe, participate in governance and economy, and create and enjoy a simple way to leverage their gaming time (The Sandbox Whitepaper, 2020: 44).

In the Sandbox metaverse, there are digital parcels denoted as LAND and in-world tokens denoted as SAND. SAND, an essential part of the Sandbox platform, is an ERC-20 token built on the Ethereum blockchain that serves as the basis for transactions on the Sandbox digital platform (The Sandbox Whitepaper, 2020: 9).

2.2.3. Axie İnfinity Virtual Reality Platform Cryptocurrency: AXS and SLP

Axie Infinity metaverse, similar to the Sandbox metaverse described above, is a "P2E" game built on the Ethereum blockchain. Axie Infinity is a game universe filled with fascinating creatures called Axies that players can collect as pets. Players aim to fight, nurture, gather, grow and build kingdoms for the Axies. The Axie Infinity virtual reality platform has a player-owned economy where players can actually own, buy, sell and trade the resources they earn in the game through skilled gaming and contributions to the ecosystem. The platform includes cryptocurrencies called Axie Infinity Shard (AXS) and Smooth Love Potion (SLP), which are ERC-20 tokens (www.whitepaper.axieinfinity.com/axs).

3. LITERATURE REVIEW

There are many empirical studies investigating bubble price dynamics in cryptocurrency markets. An important part of these researches is to investigate the price formation in Bitcoin, as well as comparisons with digital currencies and national currencies. However, no study has been found investigating price bubbles in metaverse token cryptocurrencies. With this

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[1] ERC20 is a set of rules that all tokens to be created on the Ethereum network must comply with. Thanks to these rules, tokens created on Ethereum can be easily loaded into electronic wallets that support these rules or used from wallets (Aksoy, 2018: 120).

aspect, it is hoped that the study will be a pioneering study. In this context, studies related to the subject are summarized below.

In terms of economy, the bubble; it is a deviation from basic values (Cox and Hobson, 2005). However, it is difficult to determine what the fundamental value is in cryptocurrencies (Kyrazis, Papadamou and Corbet, 2020). Phillips, Shi and Yu (2015a) and Phillips, Shi and Yu (2015b) defined the bubble as explosive price behavior. In this context, the authors have developed various statistical methods to determine explosive price behavior. Diba and Grossman (1988) performed a unit root test to detect explosive behavior in prices. To define bubbles as extensions of the Agumented Dickey-Fuller (ADF) test, Phillips, Wu and Yu (2011) and Phillips et al. (2015a), Phillips et al. (2015b) suggested methods named PWY and PSY, respectively, as abbreviations of the authors' names.

Corbet, Lucey and Yarovaya (2018), Bouri, Shahzad and Roubaud (2019) used the PSY method to identify bubbles in multiple cryptocurrencies. Corbet et al. (2018) examined Bitcoin and Ethereum cryptocurrencies and detected bubble behavior at the end of the sample period. Bouri et al. (2019) identified bubbles in seven cryptocurrencies and found that bubble periods in one cryptocurrency were associated with the presence of bubbles in other cryptocurrencies.

Cheung, Roca and Su (2015) and Su et al. (2018) found that the bubble date stamp in the Bitcoin price and the bubble periods coincided with major events affecting the Bitcoin market. Enoksen et al. (2020) examined which variables can predict bubbles in the prices of eight major cryptocurrencies. Specifically, in 2017 and early 2018, a period of multiple bubbles was identified for all eight cryptocurrencies. They determined that higher volatility, trading volume and transactions are positively correlated with the presence of bubbles in cryptocurrencies. Jalan, Matkovskyy and Potì (2022) analyzed the stock market performance of 43 companies that showed huge price increases during the COVID-19 period. As a result of the analysis, they determined that price bubbles are permanent. Apart from these studies, Cheah and Fry (2015), Fry and Cheah (2016) predicted cryptocurrency bubbles.

Although there is no study investigating price bubbles in metaverse tokens, there are performance studies on metaverse tokens. For example, Dowling (2022a) found limited volatility effects between the pricing of three NFTs and the biggest two cryptocurrencies. Nadini et al. (2021), analyzed the data of 4.1 million transactions of 4.7 million NFTs in terms of art, collection, games, metaverse and as a result; they revealed that users are specialized by category and that the most modified NFTs since July 2020 belong to the gaming industry. Aharon and Demir (2021) studied the relationship between the NFT market and other some financial assets using the TVP-VAR approach. As a result of the analysis, they determined that NFTs are independent of shocks from common assets and diversification is beneficial in times of crisis. Dowling (2022b) examined the pricing of real estate in Decentraland and found that the price series of these NFTs are associated with inefficiency and value increase. Vidal-Tomás (2022) analyzed the performance and dynamics of the new cryptocurrency, and as a result of the analysis, it was revealed that play-win and metaverse tokens are associated with positive performance in the long run.

4. METHODOLOGY

This study investigates whether a bubble has formed on the prices of MANA coin, which is the most demanded in terms of market capitalization in metacoin exchanges. However, it waa run generalized Sup ADF (GSADF) test developed by Phillips et al. (2015). In addition, the detected bubble dates are also shared.

Phillips et al. (2011) used forward recursive right-tailed ADF unit root tests to test the existence of a bubble and determine the bubble's occurrence and expiration dates, using the SADF test, Phillips et al. (2015a, 2015b) developed the GSADF test using backward recursive right-tailed ADF unit root tests. The mentioned GSADF test is also referred to as the PSY method, as explained in the literature review section. The hypotheses of the GSADF test are shown below.

H_0: δ = 1 (bubble has not formed)

H_1: δ > 1 (multiple bubbles have formed)

The following recursive sliding regression equations are used to detect the presence of price bubbles in GSADF tests (Phillips et al., 2015a: 1047):

$$\Delta y_t = \hat{\alpha}_{r1,r2} + \hat{\beta}_{r1,r2} y_{t-1} + \sum_{i=1}^{k} \hat{\psi}_{r1,r2}^i \Delta y_{t-i} + \hat{\varepsilon}_t, \tag{1}$$

The GSADF statistics calculated based on Equation 1 are shown below (Phillips et al., 2015a: 1048-1049):

$$GSADF(r_0) = \sup_{\substack{r_2 \in [r_0,1] \\ r_1 \in [0, r_2 - r_0]}} \{ADF_{r_1}^{r_2}\} \tag{2}$$

5. DATASET AND EMPIRICAL FINDINGS

The MANA token which is the meta coin of the Decentraland digital reality platform, is analyzed in terms of price bubble. The data set of the study was obtained from the address investing.com and consists of 435 daily observation values covering the periods 05.11.2020-13.01.2022. Figure 1 below shows the evolution of MANA prices for the relevant period graphically.

**Figure 1: Price Chart of MANA**
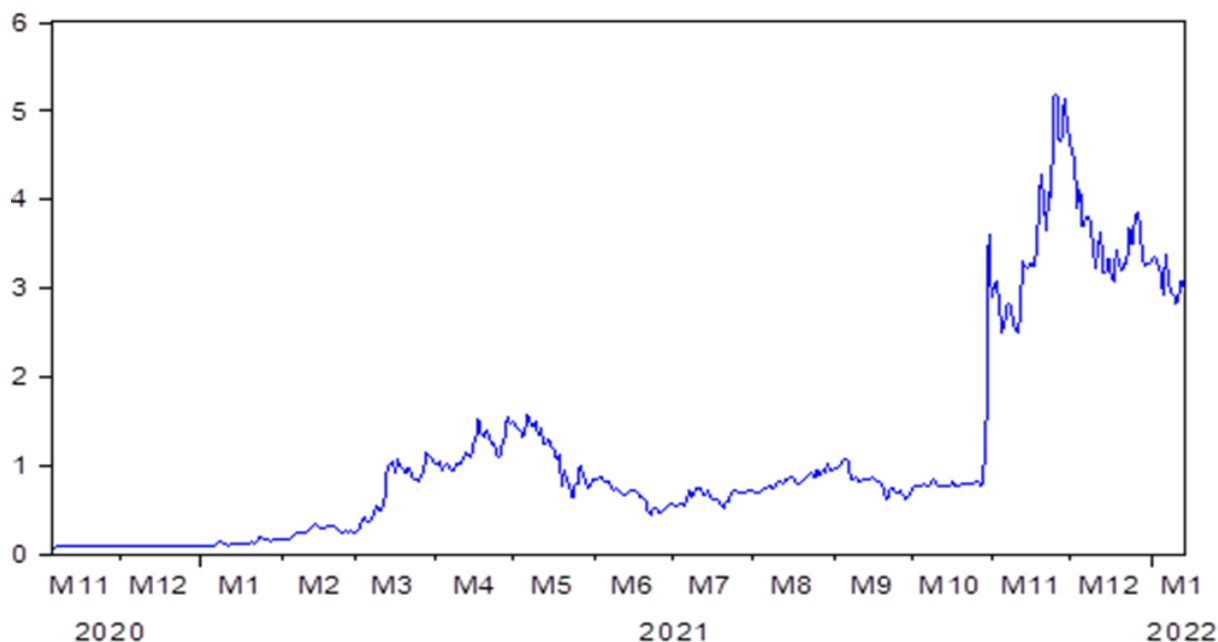
As seen in Figure 1 there are remarkable price increases of MANA price series. Especially after October 2021, there were high price movements. The test results of MANA, one of my metacoin cryptocurrencies examined in terms of bubble formation, are presented in Table 2 below.

Table 2: MANA GSADF Test Result

	GSADF Test Statistics	Critical Values		
		%1	**%5**	**%10**
MANA	19.48***	1.79	1.34	1.13

*** indicates statistical significance at the 1% level. Critical values were obtained from Monte Carlo simulation results with 2,000 replicates. The initial window width is taken as 25.

Figure 2 below shows the bubble formation periods graphically according to the GSADF test result.

Figure 2: Graphical Display of Price Bubble Formation Periods According to GSADF Test Results
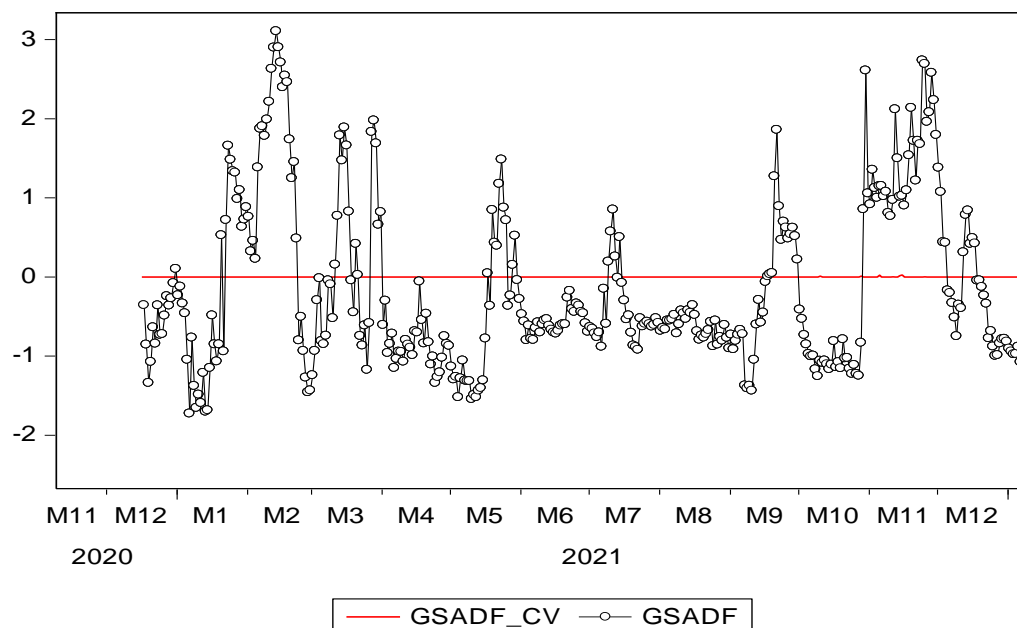
According to the findings obtained from Table 2 and Figure 2, it shows bubble formations in MANA prices at the 1% significance level. The GSADF test statistics are above the GSADF critical value. After the existence of bubbles has been confirmed, these bubble periods are also presented in Table 3.

Table 3: Display of Bubble Dates and Durations by GSDF Test Result

Number	Start	Finish	Duration(day)
1	30.12.2020	01.01.2021	1
2	19.01.2021	21.01.2021	2
3	22.01.2021	24.01.2021	2
4	10.03. 2021	18.03.2021	8
5	19.03.2021	22.03.2021	3
6	26.03.2021	01.04.2021	6
7	16.05.2021	17.05.2021	1
8	18.05.2021	25.05.2021	7
9	27.05.2021	29.05.2021	2
10	08.07.2021	12.07.2021	4
11	13.07.2021	14.07.2021	1
12	16.09.2021	30.09.2021	14
13	28.10.2021	04.12.2021	37
14	11.12.2021	17.12.2021	6

According to the results obtained from Table 3, 14 bubble periods were detected on the MANA price series. It is also observed that there are long-term price bubbles on the price series. The fact that the price bubble that started on 28.10.2021 continued for 37 days gives the impression that a serious speculative movement has taken place on the MANA token. In this direction, the bubble activity supports this findings that started on 16.09.2021 and lasted for 14 days.

6. CONCLUSION

Today, rapidly developing technology has paved the way for innovations in many fields. Undoubtedly, financial markets are one of the the forefront of these development areas. Especially the development of blockchain technology has carried many

established applications to different dimensions. The best examples of this situation are the metaverse and NFT markets, along with cryptocurrencies. Metaverse is a virtual reality platform where participants can produce and sell goods and services, as well as perform activities such as various applications, games, sharing, and their own local cryptocurrencies. For example, MANA in Decentraland metaverse, SAND in The Sandbox metaverse, AXS and SLP in Axie Infinity metaverse etc. cryptocurrencies are used.

Initially, this study investigate the metaverse and metacoins, which are not widely available in the literature, are explained, and then the bubble formations in the local currency MANA prices of Decentraland, which is the largest metaverse in terms of market capitalization. In this context, the presence of bubbles in MANA prices were analyzed by the GSADF bubble test. According to the results of the analysis, the existence of 14 different price bubble periods in the relevant period for the MANA price series has been determined. Accordingly, MANA prices are open to speculation. In this case, those who invest or plan to invest in MANA crypto money should take this fact into account.

For future studies, it can also be considered in terms of price bubbles meta coins other than MANA, which cannot be included in the analysis due to time constraints in this study. On the other hand, if price bubbles are detected as a result of bubble tests, the factors affecting the formation of bubbles can be investigated with binary preference models.

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