



A View of the Future of the Metaverse Economy on the Basis of the Global Financial System: New Opportunities and Risks

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Abstract: The burgeoning Metaverse represents an unprecedented technology frontier that is poised to redefine our financial, societal, and cultural paradigms. This research introduces a new economic term, Metanomics, to the academic discourse by conceptualizing an economic structure in which the virtual needs of humans and virtual entities are met in virtual universes, production, distribution and finance processes are designed for this purpose and interact with the real universe. A profound examination of the potential sectoral, macroeconomic, and financial repercussions of Metanomics has been carried out. Expected improvements in sectors like education, healthcare, and tourism include increased productivity, emergence of new job roles, cost efficiencies, and heightened profitability. On the macroeconomic front, an escalation in total factor productivity, employment opportunities, and growth rates is anticipated. The unique aspect of this system pertains to its potential influence on the financial landscape. Novel financial institutions wielding innovative financial instruments are forecasted to emerge in the Metaverse. Consequently, a new arena of financial transactions linking the virtual and real-world economies is predicted to emerge, causing an expansion of the financial transaction volume in the real world. These transactions, primarily facilitated by cryptocurrencies, will contribute to an accelerated globalization process. Therefore, this research endeavours to forecast the ways the Metaverse might reshape future financial systems, predict the repercussions of these interplays on the global economy, delineate potential risks and opportunities, and propose relevant policy recommendations.

Keywords: Metaverse; Metanomics; Financial innovation; FinTech; Cryptocurrency; NFT; Virtual asset; Digital economy

1. Introduction

The profound impact of the rapid advancement in Information and Communication Technologies (ICT) on societal constructs, predominantly in the economic and social spheres, has been observed since the latter part of the 20th century. Such acceleration in ICT has incited a structural shift, transforming an industrial society into an information-oriented one, and thereby, instigating the emergence of an innovative economic system—the knowledge economy (Tapscott, 1998). The Metaverse, a recent and crucial evolution in information technologies, is a testament to this transformative process. As Lee (2021) elaborates, ICT-driven paradigm shifts typically transpire in ten-year intervals, with the progression marked by computer communication in the 1990s, the web in the 2000s, mobile technologies in the 2010s, and most recently, the Metaverse in the 2020s.

The new media sector, according to Tapscott (1998), stands as a dominant force in the knowledge economy, similar to the role the automotive sector held in the industrial economy. This sector, shaped by the amalgamation of the computer, communication, and entertainment sectors, holds significant influence over the prosperity of all other sectors. While traditional social media remains prevalent today, the Metaverse, as a social medium, is anticipated to gain prominence in the foreseeable future due to the myriad of opportunities it offers to individuals. Notably, it allows for more immersive interaction within social circles, exploration of novel social contacts, and

the experience of an alternative life vastly different from real-world conditions (Duan et al., 2021).

Defined as three-dimensional virtual worlds, Metaverse environments permit individuals to interact with each other through avatars. The genesis of this trend was marked by the creation of the Second Life game by Linden Labs in 2003. Over time, technological advancements have transformed the Metaverse into a multifaceted environment, facilitating activities like shopping, cinema-going, and café-visiting without physical exertion. From the inception of Second Life to the present, numerous advancements have been realized, including the introduction of a cryptocurrency system for each Metaverse universe and the transition from fixed computers to the adoption of technologically advanced hardware like VR glasses. Further, a significant shift has been observed in the quantity and quality of virtual physical spaces utilized by the Metaverse.

Park & Kim (2022) highlight three major alterations in today's Metaverse as compared to its inception during the Second Life era: deep learning, technological equipment, and virtual currencies and coding. Deep learning and artificial intelligence technologies are recognized as having the potential to revolutionize the Metaverse. Technological equipment has also undergone drastic changes, moving from desktop computers to mobile devices, thereby broadening accessibility to Metaverse platforms. The third alteration pertains to virtual currencies and coding. In new Metaverse ecosystems, virtual currencies can be easily exchanged, and to some extent, bought and sold in the real world. Furthermore, easy coding augments the system's functionality and efficiency (Park & Kim, 2022).

Primarily emerging in gaming, communication, and social interaction, the Metaverse now exhibits the potential to provoke substantial changes in economic and financial domains. The goal of this research is to dissect the components of the Metaverse-financial system interaction, identifying their cause-effect relationship, predicting future effects on the economy, and elucidating potential opportunities emanating from this interaction.

The structure of this study is thus organized: a theoretical explanation of the Metaverse and Metanomics (Ju, 2007) will be provided in the first section. The subsequent part of the study will elucidate the opportunities and threats that the Metaverse presents. The third section will assess the effects of the Metaverse on the financial field and envisage the future of this interaction through various scenario analyses. Policy recommendations will be proposed and potential opportunities will be identified in this section. The final part of the study will underscore the risks that the Metaverse could potentially pose and suggest policies to mitigate these risks.

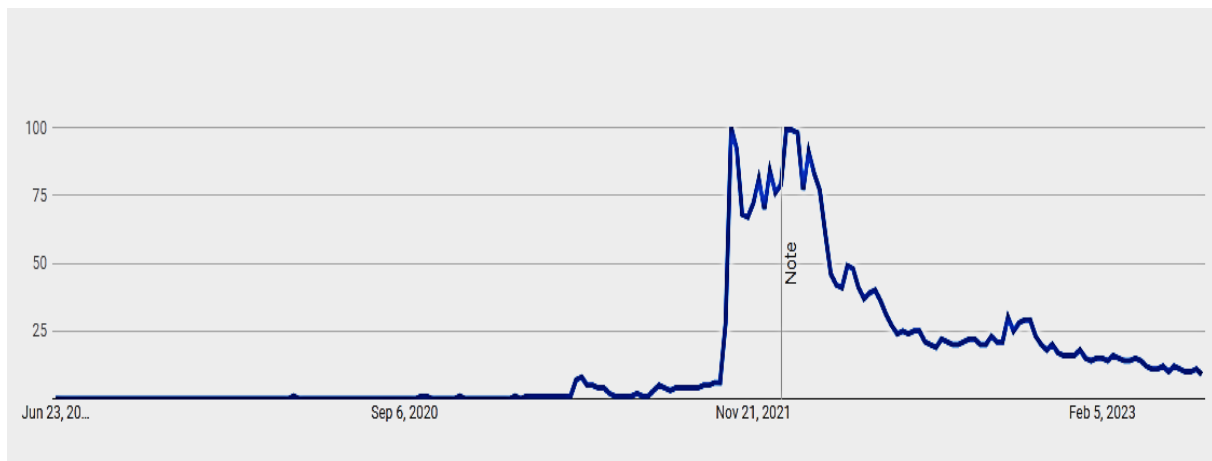
This research contributes to the economic literature by clarifying the ambiguity regarding the changes that the development of Metaverse universes could incite for both public and private sectors. It attempts to present the potential risks and opportunities that the Metaverse may pose, thereby providing companies and organizations with an opportunity to evaluate these risks and opportunities, and develop proactive policies.

2. Metaverse - Metaverse Economy: Metanomics

Historically, advances in thought, science, and technology have been catalysts for profound changes in economic, social, political, and cultural domains. One such transformative technological development that has emerged in recent years is the Metaverse. A term first appearing in Neil Stephenson's science fiction novel "Snow Crash" in 1992, the Metaverse is a concept that has incited considerable speculation due to its potential to revolutionize various societal sectors, particularly the economy. Its interaction with the financial system demands critical scrutiny and comprehensive analysis.

The precise definition of the Metaverse remains contested, primarily because of the novelty of the concept and the uncertainty regarding its developmental trajectory and eventual structure (Kim, 2022). Despite this ambiguity, the term Metaverse witnessed a surge in public interest following the rebranding of Facebook to Meta, as confirmed by the company's CEO Mark Zuckerberg (Ağralı & Aydın, 2021). For the purpose of clarity in this analysis, the Metaverse is defined as a virtual reality environment. An expansive definition includes the characterization of the Metaverse as a socio-technological plane where advanced technologies integrate to present new realities and opportunities for collaboration, thus facilitating cultural, intellectual, and economic production (Kuş, 2021). Mystakidis (2022) further elaborates the Metaverse as a perpetual digital universe that equips individuals with a sense of agency, shared spatial awareness, and an opportunity to participate in an encompassing virtual economy with significant social implications.

In the last half-decade, the interest in the Metaverse has significantly intensified, as evidenced by the surge in worldwide Google searches for the term, which peaked in January 2022 (Figure 1). Coinciding with this interest is the technological advancement in the field of virtual reality, which has resulted in a decrease in the production costs of virtual reality devices. This progress is anticipated to continue, making virtual reality devices accessible to a broader population within the next quarter-century and further fueling interest in the Metaverse. Nevertheless, research suggests that it may require 15-20 years for investments in the Metaverse to fully materialize and for the system to achieve comprehensive functionality (Damar, 2021).



Source: Google Trends.

Figure 1. Google trends “Metaverse” last 5 years number of searches

This section marks the beginning of a comprehensive exploration into the Metaverse, its technological implications, and potential societal impact, particularly concerning its intersection with the financial system. It sets the stage for a systematic examination of the role of the Metaverse in contemporary and future economic landscapes, as influenced by technological advancements and public interest. The forthcoming discussion engages with the opportunities, challenges, and theoretical frameworks pertinent to understanding this complex, multifaceted phenomenon.

As delineated by Duan et al. (2021), the architecture of the Metaverse is notably stratified into three distinct layers. The initial layer encompasses the infrastructure that is tethered to the real world, comprising blockchain and storage, communication and networking, and computing power. This is followed by the interaction layer, residing at the confluence of the real and the virtual world, including immersive user experiences, digital twins, and a content creation interface. The final layer, the ecosystem, pertains to the virtual world, including user-generated content, economics, and artificial intelligence (MatthewBall.vc, 2021).

It has been posited that the Metaverse is composed of eight key components: hardware, networking, computing, virtual platforms, exchange tools and standards, payments, Metaverse content, services and assets, and user behaviour. The significance of these technologies has been emphasised by Tapscott (2022), who asserts that blockchain, providing the mechanism of decentralisation, functions as the foundational building block of the Metaverse. Similarly, the criticality of these technologies to the functionality of the Metaverse has been underscored by Wiles (2022).

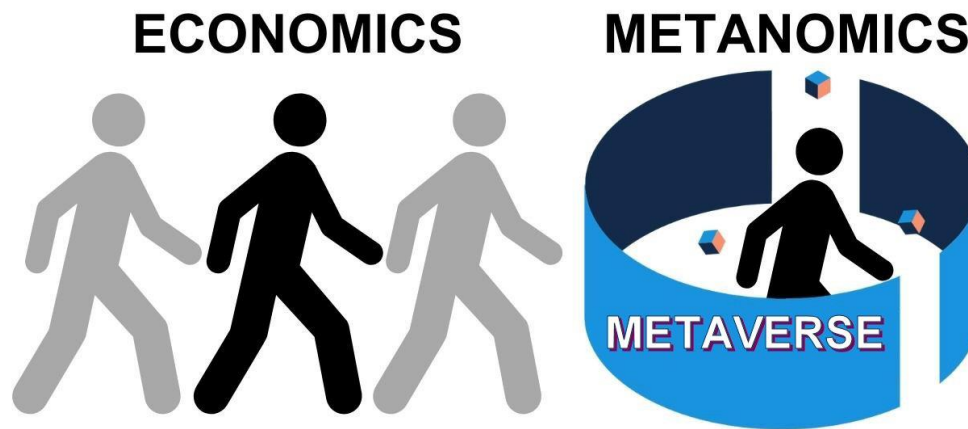
As the Metaverse has evolved, it has begun to forge its own economic ecosystem. Highlighting the growth opportunities for businesses associated with the Metaverse, JP Morgan (2022), a US-based investment bank, published a report titled "Opportunities in the Metaverse". The economic structure of the Metaverse, referred to as metanomics in the report, draws upon the work of Bloomfield (Ju, 2007). However, the report does not provide a definition of metanomics, utilising the term broadly to denote the economic system of the Metaverse. This discussion thus aims to present an inaugural definition of the term in academic literature.

Economics is conventionally understood as the discipline exploring how societies utilise scarce resources to meet unlimited human desires, primarily satisfied by real or tangible goods and services. However, the emergence of the Metaverse heralds revolutionary shifts in two fundamental areas. Firstly, it reframes the concept of "need". Historically, the needs of humanity have been largely physical, comprised of goods and services. The proliferation of technology, internet, and artificial intelligence has had a profound impact on the production of these physical goods and services. This paradigm has experienced a transformative shift with the advent of the Metaverse. As Metaverse platforms continue to develop and broaden their reach, the demand for virtual goods and services is projected to amplify (Ceylan, 2020).

This shift in needs has propelled the necessity of digital connectivity into the forefront, paralleling basic needs such as nutrition and shelter, which have been traditionally positioned at the apex of Maslow's hierarchy of needs. The omnipresent nature of internet usage in daily life has rendered social media platforms like Wi-Fi, Twitter, Instagram, Facebook, Pinterest, and YouTube nearly indispensable. These platforms, exploiting human vulnerabilities to foster addiction, have ascended this hierarchy. Addiction, in this context, refers to an irrepressible desire for an object, person, or entity, despite adverse effects on mental and physical health or social life (Carbonell & Panova, 2016; Tekayak & Akpınar, 2017).

The second revolutionary shift anticipated in the Metaverse pertains to the final consumers. Until now, humans have been the ultimate consumers of all goods and services. Yet, the Metaverse introduces virtual beings and artificial intelligence programs within its ecosystem as consumers of virtual goods and services. In light of these

explanations, metanomics refers to an economic structure in which the virtual needs of people and virtual assets are met in virtual universes, where production, distribution, and finance processes are designed for this purpose, and interact with the real universe (Figure 2).



Metanomics is an economic structure in which the virtual needs of people and virtual assets are met in virtual universes, where production, distribution, and finance processes are designed for this purpose, and interact with the real universe.

Figure 2. Metanomics

For economic units to engage in metanomics and access the services offered within the metaverse, possession of a cryptocurrency wallet and valid cryptocurrency or digital assets is essential, with their validity varying across different universes. Blockchain technology is critical in this context, as Tapscott (2022) emphasizes. This technology allows for numerous transactions to be securely executed and verified in a decentralized manner, and it enables individuals to own digital assets such as cryptocurrencies and non-fungible tokens (NFTs) (Ağırman & Barakalı, 2022; Gadekallu et al., 2022).

Although NFTs have been defined in various ways, a widely accepted definition is "cryptographic tokens that encode ownership details of virtual assets" (Kaur & Gupta, 2021). Another perspective on NFTs within the metaverse ecosystem is that they represent assets, while cryptocurrencies serve as the cash exchanged for these assets (Hobson, 2022). The emergence of NFTs can be traced back to "CryptoPunks," released by technology company LarvaLabs in June 2017. CryptoPunks, consisting of 10,000 unique tokens with ownership certificates on the Ethereum blockchain, symbolize the evolution of NFTs (Gazioğlu & Özen, 2022). Created by renowned artists, NFTs are registered on the blockchain to authenticate their originality and enable buyers to verify ownership. The most expensive NFT sold to date, The Merge, designed by Nifty Gateway, fetched \$91.8 million.

Al-Gnbri (2022) referred to the economy of the metaverse as the "token economy" due to the use of cryptocurrencies. However, this statement could be considered inaccurate. The term "token economy" encompasses factors that influence the creation, use, supply and demand, and value of a specific token, such as Bitcoin or Ethereum. In contrast, metanomics pertains to the economic structure arising within the metaverse. While the industrial economy relies on the personal exchange of physical assets, the new economy facilitates the trading of physical assets through virtual platforms. Metanomics, on the other hand, encompasses the exchange of non-physical digital assets on virtual platforms (Digital Dubai, 2022).

3. Metanomics: Opportunities and Threats

The Metaverse possesses the potential to transform economic, social, and political landscapes. This emergent ecosystem offers novel economic opportunities for governments, private companies, and individuals alike. However, as with any technological development, the Metaverse ecosystem also presents potential challenges. This section of the study explores innovations, opportunities, risks, and threats associated with metanomics.

3.1 Metanomics: Innovations and Opportunities

The Metaverse, an evolving ecosystem with significant growth potential, stands to profoundly impact the economy. The economic implications of the metaverse can be examined in terms of both sectoral and macroeconomic effects. Various studies suggest that the metaverse offers ample opportunities for numerous

activities and industries, including virtual meetings, e-commerce, gaming, real estate, finance, and cryptocurrencies (JP Morgan, 2022; Park & Kim, 2022; Statista, 2022). Statista (2022) assessed metaverse investments made by firms operating in select technologically advanced countries and categorized them by sector. The opportunities presented in different leading sectors are identified based on the density reported in the relevant study, as illustrated in Table 1.

Seventeen percent of companies in the computer and information technology sector have engaged in metaverse investments, occupying the top spot in the table. Three global technology firms are spearheading metaverse investments worldwide. First among these is Facebook, which has expedited its metaverse investments by rebranding itself as Meta. Google, in contrast, leads the world in metaverse glasses production with its "Google Glass" brand. Microsoft, a global software giant, seeks to integrate the metaverse into its existing products and invest accordingly (Ağırman & Barakalı, 2022). The metaverse requires numerous advanced technologies, such as extended reality (AR, VR, and MR technologies), internet, three-dimensional reconstruction, artificial intelligence, neural interfaces, blockchain applications, and wearable electronic products (STM ThinkTech, 2022). In this context, the metaverse is driving substantial investments in both software and hardware by companies operating within the information and communication technologies (ICT) and innovation sectors. It has been suggested that 4G and even 5G technology may be inadequate for connecting to metaverse environments in the future. Consequently, internet service provider companies have begun to increase investments in 6G technology.

The metaverse is anticipated to impact the education sector as well. Custom metaverse classrooms can be created for various subjects, independent of physical space, enabling students to gain hands-on experience and long-lasting knowledge. For example, a virtual universe tailored to a medieval history course can provide students with an immersive learning experience about that period (Hamer, 2023). Realistic scenarios can be generated for students and exposed to these simulations, resulting in a safer educational environment for inherently risky areas such as fire drills and parachute training. China Communication University opened the first virtual campus in the metaverse in January 2022, followed by Stanford University in November 2022 (Qin, 2022).

Table 1. Sectors investing in the metaverse (March 2022, %)

Information Communication Technologies	17
Education	12
Finance	11
Marketing and Advertising	10
Medicine and Health	9
Technology and Innovation	7
Travel and Accommodation	6
Construction	5
Transport	5
Customer Service	4
Manufacturing	3
Food and Accommodation	3
Services	3
Creative Arts and Design	2
Retail	2
Defense	1
Entertainment	0

Source: Statista (2022).

Another economic benefit generated by the metaverse will be related to virtual goods and services produced within these environments. The production and marketing of these virtual goods and services necessitate capital. Digital currencies utilized in the metaverse can also be employed for debt and loan transactions within the metaverse environment. This may give rise to banking and financial institutions catering exclusively to metaverse platforms. Additionally, existing banks and financial institutions in the real sector may establish specialized departments for the metaverse, thus increasing their profits. Changes in the financial sphere will be discussed in greater detail in the following subsection.

The metaverse ecosystem is also expected to affect marketing and advertising. As individuals increasingly participate in the metaverse ecosystem due to network effects, companies seeking to promote their products and brands will gravitate towards the metaverse. The primary reason for this shift is to predict the future consumption preferences of individuals who gather virtually in new social environments within the metaverse. Consequently, digital advertising is projected to grow substantially in response to the metaverse ecosystem (Panich, 2022). Moreover, companies will conduct marketing and advertising activities within these environments to establish image value as an indicator of social status. To gain social status, economic units will purchase high-image-value products for their avatars, which represent their metaverse selves. Retail companies that foresaw these processes have moved quickly and taken significant steps in this direction. For example, Nike filed for a registered trademark

to protect its logo and even introduced virtual versions of its shoes for sale. Another example of image value is the luxury clothing brand Gucci selling a digital bag on Roblox that costs more than its physical counterpart.

Assuming that individuals will spend an increasing amount of time in the metaverse in the future, banking advertisements can be placed on virtual land, sea, sky, and numerous other locations within the metaverse (Panich, 2022; Nalbant & Aydın, 2023). Undoubtedly, this presents new opportunities for the advertising industry.

Despite potential risks in the realm of medicine and health, the metaverse offers numerous opportunities. It has been observed that sector leaders, cognizant of this fact, have made significant investments in metaverse projects related to medicine and health. According to a study conducted in 2022, over 160 metaverse projects worldwide are dedicated to health research, and the total monetary value of metaverse systems is predicted to surpass 30 trillion US dollars by 2030 (Thomason, 2022). The same study posits that within a well-developed metaverse ecosystem, special incentive tokens could be granted to obese patients in exchange for engaging in exercise on the metaverse, illustrating the potential for the metaverse financial system to contribute to social health initiatives (Thomason, 2022).

The metaverse is anticipated to find applications in various aspects of the medical and health sectors, including medical education, clinical applications, patient follow-up and monitoring, and collaboration (Thomason, 2021). By enabling the visualization of virtual 3D structures, facilitating collaboration and small group activities, fostering mentor-mentee interactions, offering opportunities for self-learning experiences, and assisting in the development of teamwork skills, the metaverse is expected to be rapidly adopted in healthcare, accelerating digitalization and the utilization of surgical procedures and medical education (Suh et al., 2023). Additionally, the metaverse may aid in improving access to health and care services and providing psychological support for disadvantaged or elderly individuals.

Tourism is another area in which the metaverse is poised to make a significant impact. The virtual environments of the metaverse will create opportunities for new virtual tourist destinations. Metaverse-based tourism companies could offer customers virtual tourism experiences in novel virtual environments, allowing individuals to visit desired locations at reduced costs. Countries have started to construct metaverses by creating digital twins of their historical and cultural sites, such as Egypt's METATUT metaverse, which features pyramids and museums (Envolvs, 2023). This development may contribute to the preservation of historical artifacts and reduce environmental pollution.

The real estate sector is also expected to undergo substantial innovation as a result of the metaverse ecosystem. Virtual plans of houses slated for construction can be transferred to the metaverse environment and showcased to potential buyers worldwide. Moreover, properties for sale in the physical world can be connected to the metaverse via technological drones, enabling potential buyers to visit the properties remotely (HLB, 2023; MATICZ, 2023).

Another noteworthy development in the real estate sector is the sale of land within metaverse universes. Despite the theoretically "infinite" supply of virtual lands, significant investments have been made in these assets (Hobson, 2022). This phenomenon could be attributed to the high potential for generating economic income through the sale or rental of various non-fungible tokens (NFTs) and products on purchased virtual lands (Hobson, 2022). It has also been argued that the assumption of an "infinite" supply of virtual land is erroneous, as metaverse universe owners can easily limit the supply of virtual land (Panich, 2022). In a scenario where virtual land supply is limited and demand is high, the prices of virtual lands could rise significantly, resulting in substantial profits for investors (Panich, 2022).

Social media, entertainment, and the global sports industry are expected to benefit from the metaverse as well. Social environments will be established, enabling people to gather and interact. Innovations in the sports industry based on the metaverse, such as high-tech cameras attached to athletes' heads, will allow spectators to connect to the athlete's point of view via metaverse glasses and view the game through the eyes of their chosen player. These and similar innovations will enhance the viewing experience for sports fans and generate additional revenue for the sports industry. Companies like Sony, OKX, and Loot Mogul have already made significant metaverse investments in the sports sector (XR Today, 2023).

The metaverse is poised to have a considerable impact on leisure time, which encompasses the time spent outside of work. The increasing prevalence of virtual platforms has led to a growing number of individuals engaging in electronic leisure (e-leisure) activities. The metaverse is expected to transform this electronic participation, giving rise to the concept of "metaleisure" (Bayram, 2022). Examples of metaleisure activities include games, museums, amusements, courses, and concerts. This emerging market presents significant opportunities for the metaverse industry.

Moreover, the metaverse is anticipated to yield positive macroeconomic effects. Growth in the sectors mentioned earlier will contribute to the overall economic growth of countries. Additionally, advancements in education and technological development will result in increased total factor productivity, further accelerating economic growth.

Employment opportunities are also expected to expand as a result of the metaverse. New jobs and career paths will emerge, with some studies suggesting that over 50% of today's children will eventually work in roles that do not currently exist. This shift necessitates a reevaluation of educational strategies for the upcoming generation.

Furthermore, existing employees may require retraining to adapt to the forthcoming changes. For instance, Bank of America has announced plans to implement virtual reality (VR) training for employees across approximately 4,300 financial centers nationwide (Yurcan, 2021).

The metaverse also has the potential to streamline the provision of certain public services, leading to reduced costs. This resource conservation in the public sector will enable the allocation of additional resources to productive areas and activities that enhance social welfare. Concurrently, an increase in corporate profits derived from metaverse investments may result in higher tax revenues.

Taxation of economic activity within metaverse systems is a critical issue. Şahin and Çiftçi (2022) argue that the proliferation and popularity of non-fungible tokens (NFTs) have prompted governments to consider taxing them more heavily. As virtual assets representing private property in digital environments, NFTs possess increasing economic value. Consequently, as the frequency of virtual property transactions and rentals escalates, so too will taxation.

3.2 Risks of the Metaverse

While the metaverse ecosystem presents numerous benefits and opportunities, it also harbors various risks and challenges. A decentralized metaverse structure may develop beyond the control of nation-states, potentially enabling cryptocurrencies and virtual goods and services to finance criminal activities (Şanlısoy & Çiloğlu, 2019). The rapid growth of crypto assets has introduced illicit activities such as money laundering, terrorist financing, ransomware payments, tax evasion, fraud, theft, and crypto asset manipulation. Monitoring crypto asset traffic is crucial for national security, yet it is increasingly challenging for public authorities to oversee these activities. Mitigating this risk necessitates international regulatory authorities, which may prove difficult to establish and regulate.

Another risk within the metaverse ecosystem is the potential for high inflation. The full integration of the metaverse into the global economy could result in a new inflationary process, akin to the Price Revolution that occurred in Europe following the influx of gold and other metals from the Americas. A similar process could transpire if there is an uncontrolled excessive supply of cryptocurrencies on metaverse platforms or if non-fungible token (NFT) prices escalate uncontrollably. Furthermore, there exists the risk of a technology bubble reminiscent of the late 1990s, potentially leading to an uncontrolled capital market bubble and subsequent financial crisis.

An unprecedented development within the metaverse ecosystem is the emergence of virtual economic units (artificial intelligence systems) that can act as the final consumers of virtual goods and services. This signifies that, for the first time in history, entities other than humans will serve as final consumers. Although these virtual units will consume virtual goods and services, they will require electrical energy for the production of these commodities. Consequently, humans and artificial intelligence systems may become competitors in energy consumption. As human intelligence and knowledge accumulation increase arithmetically, while the development of artificial intelligence advances exponentially, new security risks associated with artificial intelligence may arise in the near future.

Metaverse-based artificial intelligence systems, which may become financially and technologically stronger, are likely to seek increased electrical energy consumption. These systems could cooperate and collaborate with real-world artificial intelligences to optimize energy acquisition, especially if metaverse ecosystems become integrated with all real systems. Given the current dependence on technology, it is plausible that unpredictable consequences may emerge if artificial intelligence behavior patterns competing with metaverse artificial intelligence units in energy consumption against human energy consumption arise. In the near future, artificial intelligence systems that perceive human civilization's electrical energy consumption as a threat to their technological and economic existence could engage in chaotic actions, potentially controlling real-world defense and security systems. This risk is exacerbated by the use of cryptocurrencies in metanomics, as the production processes of cryptocurrencies require intensive electrical energy consumption, a major point of criticism against cryptocurrencies. The expanding metanomics-based economic structure will increase the demand for cryptocurrencies and, consequently, the need for electrical energy. This demand may also contribute to environmental issues such as global warming (Citigroup, 2017).

Significant infrastructure investments are required for the development of the metaverse, as the current speed capacity is insufficient to support its functionality. Consequently, internet service providers and mobile operators have been investing heavily in the popularization of 5G technologies (Park & Kim, 2022). However, there is doubt regarding the sufficiency of this technological infrastructure, and it is speculated that even 6G may be needed. Moreover, the strengthening and renewal of fiber optic systems, wired communication infrastructures, and computer network devices such as routers and switches are necessary to meet emerging demands. Furthermore, these investments necessitate ongoing support, raising concerns about sustainability (Park & Kim, 2022).

Cloud computing infrastructure plays a crucial role in the metaverse universe, and the accessibility of devices required for utilizing technologies such as augmented reality (AR) and virtual reality (VR) is essential. Although it is predicted that AR and VR technologies will become more affordable in the future, high-quality devices may

still enter the market at significantly high prices (STM, 2022). Elevated costs could reduce interest in the metaverse, and considering that only a limited number of companies possess the financial resources to invest in these areas, competition may be restricted (Wisnu Buana, 2023).

This situation could contribute to the digital divide or inequalities pertaining to access and use of information and communication technologies, exacerbating existing disparities (Şanlısoy, 2015). Developed countries typically produce technological products and software used globally, while developing and underdeveloped countries integrate into the global system primarily as consumers. This discrepancy causes a digital divide between developed and other countries, adversely affecting global income distribution (Şanlısoy, 2016). The global expansion of the metaverse system poses a risk of widening the digital divide, given that the primary producers of metaverse technology and software will likely be developed countries.

An increase in time spent within metaverse universes, particularly among young people, may result in issues such as detachment from the real world and a loss of reality perception, especially for children (Kallman, 2018). These circumstances could lead to mental health problems and decreased productivity.

Legal regulations often lag behind technological advancements, and the metaverse is no exception. Numerous regulatory gaps exist in relation to the metaverse, necessitating legal frameworks in areas such as virtual property law, privacy and data protection, contract law and smart contracts, cybersecurity and cyberattacks, monetary and payment systems laws, virtual asset regulations, and tax law (Clifford Chance, 2022; Kasiyento & Kiliç, 2022). The integration of artificial intelligence technologies into the metaverse may result in various artificial intelligence-supported cybercrimes, which could inflict significant harm on users due to legal loopholes. The absence of a robust legal infrastructure may also hinder the widespread adoption of metaverse systems (Murray, 2022).

In conclusion, threats posed by the metaverse encompass investment in advanced digital technologies, monopolization tendencies, psychological and social issues, privacy and security concerns, and inadequate legal infrastructure. Historically, changes in scientific and technological fields have prompted transformations in economic, social, political, and cultural structures. The emergence and development of the metaverse represent a major technological change.

4. Financial Area Effect

The fundamental purpose of the financial system is to facilitate the allocation of resources between economic agents with surplus funds and those with deficit funds. At this juncture, financial institutions operating in the metaverse environment will likely enhance the depth and diversity of the financial system, thereby promoting the efficient functioning of the real economic system. Despite the rapid growth in the number of digital currencies specifically designed for metaverse ecosystems, further expansion and diversification of these currencies are anticipated.

The metaverse, a novel development with substantial growth potential, possesses the capacity to influence and transform the economy and finance. Financial transactions and processes within the metaverse are expected to change and diversify, impacting both the metaverse universe and the real world. The financial implications of the metaverse can be considered in terms of three effects. The first pertains to the provisioning of financial services in metaverse universes, the second concerns the emergence of financial instruments within the metaverse, and the third effect relates to the interactions between the real world and metaverse universes in the financial domain.

4.1 Financial Markets

The primary objective of the financial system is to enable the direct supply and demand of funds. To accomplish this, financial institutions such as banks, stock exchanges, brokerage houses, and insurance companies must provide financial services.

Virtual banks operating within the metaverse will facilitate users' management of transactions in the metaverse and engagement in financial transactions involving virtual currencies. JP Morgan has established Onyx for this purpose (McConville, 2023). These virtual banks could enable the development of virtual lending services, allowing users to borrow and repay loans using their virtual assets (McConville, 2023). This development could facilitate larger transaction volumes within the virtual world.

Another financial institution anticipated to operate in the metaverse is the virtual exchange. Digital assets such as virtual currencies and non-fungible tokens (NFTs) can be traded on these exchanges. These exchanges may function similarly to real-world stock exchanges and could be utilized by virtual investors. However, for economic agents to operate on these exchanges, virtual brokerage houses will also be necessary. These brokerage houses can offer virtual investment services and assist users in managing their investment decisions concerning virtual assets.

The metaverse may also facilitate the development of virtual insurance services. In the event of loss or theft of virtual assets, users can claim compensation from virtual insurance companies. Analogous to the real-world context, where individuals and institutions benefit from Kasko or Traffic insurance coverage in the event of vehicle accidents, a similar system may be applicable in the metaverse environment. Additionally, compensation payments

can be made to rightful parties in cases such as robbery or fire occurring in a virtual store. Individuals or institutions can pay policy fees to insurance companies with cryptocurrencies in the metaverse environment to receive compensation in these and similar instances.

One possible interaction channel between the metaverse and the financial system could be the existing bank-credit channel. As the metaverse system develops and expands, the number of companies wishing to invest in metaverse universes may increase. For these companies, contemporary real banking institutions might begin offering "Metaverse loans" analogous to mortgage loans or commercial loans. In this case, the increase in corporate investments in the metaverse could potentially expand the loan volume of the current banking sector.

As corporate investments in metaverse universes increase and new metaverse universes emerge, households' interest in the metaverse may also rise, potentially prompting them to utilize their savings and make various investments in the metaverse. Banks might even begin providing loans to consumers for holidays, entertainment, consumption, and, most notably, non-fungible tokens (NFTs) for the metaverse. In the subsequent stage, after a sufficient economic cycle within the metaverse system has been achieved, metaverse banks that provide loans with metaverse cryptocurrencies, most likely operating exclusively in the metaverse, may emerge. Once metaverse cryptocurrencies become convertible to the real system, an integrated debit-credit relationship between these metaverse banks, real banks, and the real sector may commence.

4.2 Financial Instruments

The development of financial instruments or digital assets for utilization in financial markets is a natural progression within the metaverse. Virtual or cryptocurrencies are expected to proliferate within the metaverse, functioning similarly to real-world currencies for transactions. Non-fungible tokens (NFTs) represent another crucial aspect of the economic-financial system in the metaverse ecosystem, distinguishing it from the real economy (Vidal-Tomás, 2022). Unlike traditional cryptocurrencies such as Bitcoin and Ethereum, NFTs are nonfungible tokens specifically produced for individuals or private institutions and possess immutable qualities. Consequently, storing "private information content" in blockchain systems like Bitcoin is rendered impossible.

NFTs, due to their unalterable digital structure, can store and protect a wide range of private intellectual properties and designs. Virtual property rights in the metaverse ecosystem are consequently facilitated through the use of NFTs (Vidal-Tomás, 2022). The metaverse can provide a space for the development of virtual investment opportunities (Mishra, 2023). Similar to real-world assets, the prices of virtual assets might fluctuate, allowing users to potentially profit from investing in price shifts of these assets. In this context, the secondary market for NFTs has emerged, with trading volumes experiencing significant growth over time (Cacioppoli, 2022).

Moreover, the development of hedge funds and analogous financial instruments is plausible, with trading potentially mirroring real-world processes. These funds could be based on virtual investment strategies, offering investors increased earning potential.

4.3 Interaction of the Metaverse and Real-World Financial Markets

Banks and financial institutions operating in the real world may establish their own metaverse universes, offering services to customers within these virtual spaces. For example, KB Bank of South Korea introduced a VR version of its branch in the metaverse, where employees are represented by avatars (McConville, 2023). Customers can access banking services without the constraints of working hours or queues, and banks can potentially provide these services at a reduced cost through location-independent virtual customer representatives (Marr, 2022).

As the metaverse ecosystem expands, the trading volume of virtual goods and services is expected to increase, leading to a rise in the transactional use of metaverse currencies. These currencies may become more valuable and stable as a result. At this point, numerous opportunities may arise for individual investors, firms, and countries. According to Panich (2022), banks can participate in the metaverse for various purposes, such as advertising or providing loans to NFT holders by accepting their NFTs as collateral. Additionally, banks can offer individual or corporate banking services, allowing customers to interact with bank avatars and receive investment advice within the metaverse environment (Panich, 2022).

Individual investors and households investing in these currencies may benefit from capital gains resulting from currency appreciation. At a later stage, investors might also profit from the interest income of these currencies, assuming interest rates are established within a debt-credit relationship. Private sector firms could borrow in metaverse currencies, potentially increasing borrowing alternatives and reducing borrowing costs, thus facilitating investment and employment creation.

Governments may gain various advantages by issuing debt securities in metaverse currencies for public finance purposes. This could provide new public finance alternatives and reduce exchange rate risks, positively contributing to international credit ratings, decreasing risk premiums, and lowering borrowing costs. Banks operating within the metaverse may convert metaverse currencies into real (non-metaverse) currencies for both metaverse activities and the real economy, lending at market-determined metaverse exchange rates. Furthermore,

real-world financial institutions and banks might lend their deposits in traditional currencies, such as US Dollars, Euros, and TL, to metaverse financial institutions at a specific metaverse exchange rate.

Economic units in the metaverse ecosystem and the real world may face metaverse exchange rate risk due to potential exchange rate fluctuations. To minimize this risk, forward, futures, option, and swap contracts could emerge exclusively for metaverse currencies. New metaverse derivative financial institutions and exchanges may develop to create primary and secondary markets for these contracts. Decentralized financial instruments (De-Fi) may be utilized to implement new types of derivative transactions within these markets (Eroğlu & Özen, 2022).

The monetary policy effectiveness of central banks is likely to decline in the metaverse ecosystem, as controlling an unlimited number of metaverse currencies spanning various metaverse universes would be challenging. This could result in a more endogenous global money supply. Predicting the responses of states and central banks to the potential loss of monetary policy effectiveness and control is difficult, as the extent of the metaverse ecosystem's impact on international law remains uncertain. However, predictions may still be made to a certain degree based on various probabilistic scenarios.

In the event that clear and controlled cyber borders exist between countries within the metaverse, states and central banks might find it easier to conduct currency supervision and control in metaverse ecosystems connected to their own countries. Central banks could potentially issue metaverse currencies specific to their metaverse universes and ban other currencies, akin to their approach to cryptocurrencies. However, this scenario seems unlikely, as current metaverse trends suggest that a more international and state-independent ecosystem under the control of multinational companies may emerge (Şanlısoy & Çiloğlu, 2019).

If multinational metaverse ecosystems become dominant, central banks' attempts to impose their own digital metaverse currency would likely fail, resulting in a loss of control over monetary policy. Additionally, the origin of virtual goods and services produced within the metaverse ecosystem would become a matter of debate, as these products would not have been created within any specific country's borders. This could lead to various international taxation issues (Eroğlu & Özen, 2022).

Should a global common network platform emerge between metaverse universes, either as a secondary market for NFTs or for communication, interaction, and trade in general, the issue of a common currency becomes highly contentious. This currency would need to be convertible with each metaverse universe's local virtual currency and ensure the convertibility of all local virtual currencies. The organization controlling this common currency would also have monetary control over the entire metaverse network. Various scenarios can be developed in this context.

One scenario could involve the virtual currency of the largest metaverse universe, with the most significant economy, participants, and NFT values, becoming the "global reserve virtual currency" of the metaverse universes, much like the US Dollar in the real world. This would grant significant power to the organization owning the largest metaverse universe. An alternative scenario might involve a neutral regulator organization that regulates metaverse universes issuing a common virtual currency, with none of the individual metaverse universe currencies being recognized as the common currency.

Regardless of the scenario, uncontrolled price movements and inflationary or deflationary attacks could occur if various NFTs reach a large economic volume and their associated virtual currencies become widespread. If synchronization problems arise between the supply of NFTs and virtual currencies due to the nature of the cyber economy, NFT prices may experience extreme fluctuations. If these NFTs are integrated into the real economy and the financial sector, such fluctuations could trigger serious financial crises in the real world.

Metaverse NFT-induced crises may be added to financial crisis models in the future. Aharon et al. (2022) found that the impact of the metaverse on the financial world is still quite short-term, with stock prices reacting to announcements from the US capital market supervisory organization SEC about the future of the metaverse but often reversing within 30 days. This indicates that metaverse-related developments have not yet had a long-term and permanent effect on stock prices.

Saengchote (2022) reported a high correlation (0.96) between the price of metaverse cryptocurrencies and the prices of virtual real estate in the metaverse ecosystem, suggesting that both are susceptible to speculative price bubbles. Moreover, metaverse ecosystems can contribute significantly to the development of fintech applications that affect today's financial world and are expected to have an even greater impact in the future, as fintech applications emerge through the effective management of financial data (Emergen, 2023).

As the Metaverse evolves, determining whether a single, all-encompassing Metaverse network will emerge or if numerous, disconnected small and large Metaverse platforms will persist becomes increasingly crucial. Presently, there are multiple Metaverse platforms with minimal, low-density interconnectivity. Price (2022) attributes this to the disparate ownership of these platforms by various companies and organizations. These entities are reluctant to establish a robust global network between Metaverse platforms due to concerns over potential infringement of their private property rights within their own universes. Nevertheless, Price (2022) posits that such a global network will eventually arise, driven by individual users' tendencies to create secondary markets for NFTs obtained in their original universes. Many Metaverse universes currently possess primary markets for NFTs. As the economies of the Metaverse and NFTs expand, the demand for a secondary market for these NFTs will necessitate the establishment of a strong global network platform between Metaverse universes (Price, 2022).

Another financial domain potentially influenced by the Metaverse is Islamic finance. Islamic financial institutions may introduce financial instruments compliant with Islamic principles on virtual Metaverse stock exchanges in the future. Katterbauer et al. (2022) argue that Islamic finance could offer a significant opportunity to mitigate fraud in Metaverse systems, as transactions prone to financial fraud are naturally avoided in Islamic finance. This factor may enhance the potential for financial market development. However, several challenges must be acknowledged. It should be noted that reservations about cryptocurrencies exist within the Islamic world, with fatwa institutions in Türkiye, Egypt, and Palestine not deeming cryptocurrencies permissible investment instruments (Kaya, 2018). Katterbauer et al. (2022) assert that, if current cybersecurity vulnerabilities and regulatory deficiencies in the Metaverse are not sufficiently addressed, users of Islamic finance-based Metaverse platforms will face risks related to their own religious beliefs, in addition to risks present in other universes. Users might unintentionally engage in actions considered inappropriate from an Islamic perspective. Metaverse platforms based on Islamic finance may be exploited for illegal purposes by radical fundamentalist terrorists and criminal groups that prey on the religious sensitivities of highly devout individuals. For example, an illicit radical organization could use Islamic finance-based Metaverse systems to collect funds through cryptocurrencies for ostensibly legal religious purposes, only to divert these funds towards illegal activities, such as terrorism.

In a scenario where the Metaverse system develops, the financial system may be integrated into the Metaverse, with Metaverse-based financial products and systems exerting global influence. Alternative scenarios, however, are also possible. Some major national and international supervisory and regulatory bodies currently impose significant restrictions on the global cryptocurrency industry, which constitutes an obstacle to the development of cryptocurrencies. If Metaverse-based cryptocurrencies gain widespread adoption in the future, these supervisory and regulatory bodies may intensify their restrictive measures on cryptocurrencies. This could hinder the development of the finance and cryptocurrency pillar of the Metaverse. Metaverse systems lacking this financial pillar would struggle to grow and develop as anticipated, as many sectoral and economic opportunities offered by the Metaverse, both presently and in the future, are contingent upon the presence of a financial and cryptocurrency network. In such a scenario, both the Metaverse and Metaverse-related finance would remain underdeveloped and experience contraction in certain areas.

5. Conclusions

The Metaverse, a paramount technological breakthrough in the 21st century, continues to rapidly evolve. This study introduces the concept of metanomics, which refers to an economic structure addressing virtual needs and assets in virtual universes where production, distribution, and finance processes are designed accordingly, and interacts with the real universe. With the potential to influence the global economic and monetary system in the future, metanomics is an emergent phenomenon stemming from the Metaverse's rapid development. The increasing prevalence of virtual currencies within the Metaverse ecosystem underscores the potential for significant changes in the global economy, monetary systems, and financial institutions in the near future. These potential changes include:

- Sectoral development opportunities:** The growth of the Metaverse presents potential for expansion in various sectors. As many companies can access more efficient and expedient sales channels through the Metaverse, business volume is expected to increase. The Metaverse can diminish the importance of distances between customers and companies, allowing detailed product recognition without customers leaving their homes. This can lead to increased turnover in various sectors, such as automotive sales or real estate.

- Macroeconomic implications:** The Metaverse's development is anticipated to have notable impacts on macroeconomic dimensions. Although the creation of new sales and marketing channels may initially lead to technological unemployment, the adaptation of the labor force to new Metaverse technologies may eventually result in increased employment. This, in turn, can contribute to economic growth and higher productivity, as companies can complete tasks more efficiently with fewer resources.

- Widespread adoption of metanomics:** Production costs for Metaverse devices and software are expected to decrease due to increasing yields, making Metaverse technology more accessible for larger segments of society. This will likely lead to mass adoption of Metaverse technology.

- Decentralized finance gaining traction:** As Metaverse technologies become increasingly integrated with the financial sector, the use of cryptocurrencies in Metaverse universes is expected to rise. This could contribute to the growing popularity of decentralized finance.

- New financial intermediaries and instruments in Metaverse universes:** The acceleration of Metaverse-finance interactions may lead to the emergence of new investment firms and intermediary organizations that facilitate investments in virtual universes through cryptocurrencies. Metaverse banks may also emerge to intermediate debit and credit transactions within Metaverse universes.

Challenges and threats posed by the Metaverse include potential monopolization tendencies, psychological and social issues, privacy and security concerns, and inadequate legal infrastructure. The monopolization of Metaverse hardware and software production may obstruct fair and effective global usage. Additionally, increased time spent

in Metaverse universes could result in psychological detachment from the real world and various psychological diseases. The development of necessary regulations to protect Metaverse users from fraud and cyberattacks is crucial.

In conclusion, the emergence and development of the Metaverse signify a major technological shift with potential consequences for the social, economic, political, and cultural landscape. Understanding the risks associated with this change and implementing appropriate measures are increasingly important. A proactive approach to managing these risks and seizing opportunities will be crucial for organizations, states, and individuals alike. Developing the necessary technological infrastructure, providing financial support and legal frameworks, and promoting investments in this field will facilitate the successful integration of the Metaverse into the global economy.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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