Exploration of Valuation Issues for Digital Assets

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Abstract. Since The 19th National Congress of the Communist Party of China, China's digital economy has entered a stage of full development. The Fourth Plenary Session of the 19th Central Committee proposed to incorporate digital elements into distribution based on their contributions as production factors. Today, the digital economy has permeated various aspects of social life. How enterprises effectively utilise digital resources and fully explore the value of digital assets has become a key factor in building core competitiveness. However, due to limitations in the valuation methods of digital assets and the inherent difficulties in valuing them, their value fluctuates with processing, users, usage frequency, and the market. Therefore, this article reviews academic perspectives on the valuation of digital assets, considering their unique characteristics such as long-term reusability and value appreciation compared to traditional assets. It discusses valuation methods including cost-based, market-based, and income-based approaches, aiming to provide insights for future applications in digital asset valuation.

Keywords: Digital assets; Value assessment; Digital economy.

1 Introduction

President Xi Jinping pointed out at the APEC meeting on November 18, 2018, that the digital economy has become the direction of global development, and countries need to elevate the digital economy to a strategic reserve height. Especially during the three-year battle against the COVID-19 pandemic, the significant supportive role of digital technology in the stability of society and economic recovery has been particularly evident. Online education, telemedicine, remote work, cross-border e-commerce, among others, have injected powerful momentum into the globally weakened economy. Currently, with strong government support, digital technology companies in China are continuously encountering new development opportunities and making breakthroughs in areas such as the internet, big data, cloud computing, etc. The integration of the digital economy in industries such as industrial, agricultural, medical, educational, and energy sectors is becoming more profound.

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According to statistics from the China Academy of Information and Communications Technology, the proportion of the digital economy to GDP has been increasing year by year. The overall scale has grown from 18.6 trillion yuan in 2015 to 51.9 trillion yuan in 2022(Figure 1), with the proportion of GDP rising from 21.6% to 42.88%. Predictions from relevant departments suggest that the size of China's digital economy will exceed 60 trillion yuan in 2025, with its proportion to GDP surpassing 50%. Data has become the fifth factor of production. Data assets, as an emerging asset type in the process of economic and social digital transformation, are increasingly becoming important strategic resources for driving the construction of Digital China and accelerating the development of the digital economy. The Party Central Committee attaches great importance to the construction of Digital China and the development of the digital economy, making a series of important decisions and deployments.

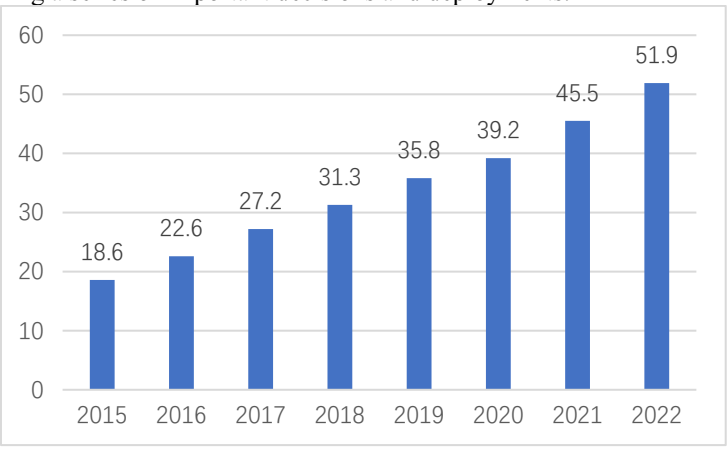

Fig. 1. Scale of China's Digital Economy from 2015 to 2022 (Unit: trillion yuan)

Data assets, as an emerging type of asset in the process of economic and social digital transformation, are increasingly becoming important strategic resources driving the construction of Digital China and accelerating the development of the digital economy. To comprehensively implement the decisions and arrangements of the Central Committee of the Party, the Ministry of Finance has formulated the "Guiding Opinions on Strengthening the Management of Data Assets", which mainly include eighteen aspects such as general requirements, main tasks, and implementation guarantees. This demonstrates the determination of the Chinese government to promote the sharing of digital economy dividends among all people, fully unleash the value of data assets as the goal, boost confidence in promoting the compliant and efficient circulation and use of data assets as the main line, orderly advance the digitalization of data assets, strengthen the full-process management of data assets, and better leverage the value of data assets.

With the deep integration of digital technology into various industries, most enterprises have incorporated digital elements as production factors into their production and operation activities, thus forming digital assets for enterprises. Compared to physical assets of enterprises, digital assets, in virtual form, have cost advantages and create

greater value for enterprises through continuous data mining, correlation, and regeneration. As the digital economy continues to develop and create more opportunities, it also faces many challenges. China's leading digital economy is at the forefront in areas such as new consumption and new business models globally, exploring a unique path of digital economic development without mature experience to draw upon, only gradually growing through the process of feeling our way across the river. Currently, the most pressing issue in the field of the digital economy is how to achieve rapid appreciation of digital assets and scientifically evaluate digital assets. In the wave of the digital economy, rationally determining the value of digital assets has gradually become a core issue, which is also a challenge that the development of the digital economy must face.

2 Literature Review

2.1 The Concept of Digital Assets

Scholars' research on digital assets begins with the digitization of asset information. The digital form of assets is known as digital assets. The concept of "data assets" was first proposed by Richard E. Peters (1974), and with the development of information technology and the internet, its meaning has undergone significant changes. A substantial amount of research on data assets began with the rise of the concept of "big data."[1] In the digital economy era, all information that people can transmit and receive can be digitized, and digitized information can be traded, thus forming assets. Scholars such as Lv Yuqin (2003) believe that electronic newspapers, songs, e-books, and enterprise databases exist in digital form, making them all digital assets. Digital assets are intangible but can bring expected returns to companies[2]. Tony Fisher (2009) stated that "data is an asset," and digital assets are traditional assets processed and transformed through binary encoding. Their storage and operation require special media[3]. Data scientists Viktor Mayer-Schönberger and Kenneth Cukier (2013) made it clear in their book "Big Data: A Revolution That Will Transform How We Live, Work, and Think" that including data assets in a balance sheet is not a matter of possibility but a matter of time[4]. According to the China Academy of Information and Communications Technology's "2017 Data Asset Management Practice White Paper," data assets are defined as "data resources owned or controlled by enterprises that can bring future economic benefits to the enterprise and are recorded in a certain way."

With the emergence of Bitcoin, numerous scholars have turned their focus to the study of digital assets, with the main point of contention being whether Bitcoin possesses the characteristics of currency, and whether it can replace traditional currency. By analysing the characteristics of Bitcoin, they hope to draw conclusions. Digital assets not only include monetary assets such as Bitcoin, Ethereum, and other cryptocurrencies, but also personal assets such as audio novels, voice, video copyrights, and so on. According to Yi Xianrong (2018), a general analysis of Bitcoin's financial risks based on modern financial theory shows that digital tokens led by Bitcoin have fundamental flaws. The primary flaw is the instability of its intrinsic value, followed by its lack of strong credibility and relatively low acceptance in the economic and social

spheres. Therefore, it is believed that Bitcoin does not hold an equivalent status to traditional currency, and is not significantly different from past occurrences of private currencies[5].

2.2 Valuation of Digital Assets

In the era of the digital economy, digital assets have become a new key factor of production. An increasing number of scholars are researching the issue of valuing digital assets. The process of valuing digital assets is influenced by various factors, and scholars have different perspectives on the factors affecting the valuation of digital assets. Zhang Zhigang et al. (2015) believe that the cost and application of data assets are the main factors affecting the assessment of operational data assets[6]. Xu Yi (2017) suggests that factors such as the physical characteristics, legal restrictions, and financial features considered by market participants when pricing assets also impact the evaluation of digital assets[7]. Li Yonghong et al. (2018) point out that factors influencing the valuation of data assets include data analysis capabilities and data quality[8]. Zou Zhaoju (2018) argues that the value of big data assets is positively correlated with factors such as the cost, quality, data volume and accuracy, ownership, and exclusivity level of data assets, while it is negatively correlated with factors such as the level of data asset risk exposure and the age of data assets[9]. Liu Chenxiang et al. (2020) analyse the impact of new generation information technologies such as big data, 5G, and blockchain on the methods of evaluating digital assets and asset valuation activities, providing effective recommendations for the asset valuation industry[10]. Jiang Yuyong (2021) suggests that the trading mode of big data affects transaction costs, thereby influencing the cost of asset valuation[11]. Yin Chuanru et al. (2021) argue that the factors affecting the value of digital assets vary in different application scenarios, leading to different values[12].

Researchers have been studying methods for valuing digital assets and improving previous methods of digital asset evaluation. Pan Weihe (2010) advocates for the comprehensive use of market approach, income approach, and cost approach when assessing the value of intangible assets[13]. Wang Jianbo (2016) proposes the use of artificial intelligence and game theory to evaluate the value of data assets[14]. Liu Qi et al. (2016) suggest using the market approach to evaluate the value of data assets, adjusting for factors such as technological level and value density, to assess the value of similar big data assets[15]. Zuo Wenjin et al. (2019) introduce the Shapley value method and bankruptcy allocation rule to propose a method for decomposing and valuing big data assets, addressing the challenge of reflecting the combined value effect of big data assets[16]. Sun Xiaoxuan et al. (2020) propose a calculation method for valuing data assets based on Lorenz transformation and PageRank algorithm, demonstrating its efficiency, stability, and effectiveness[17]. Li Hong et al. (2020) analyse a case study of SF Express to determine a reasonable value for the company's data assets and provide effective suggestions for the evaluation procedures of digital asset assessment[18]. Zhang Zhiqiao et al. (2021) analyse the composition of data asset value under traditional asset valuation methods, study the shortcomings of these methods, and suggest that the valuation of data assets needs to be improved based on their characteristics, building upon existing theoretical methods[19].

3 The Definition and Characteristics of Digital Assets

3.1 Definition of Digital Assets

The emergence of digital assets has been closely intertwined with the progress of the internet and other scientific technologies. It can be said that digital assets are products jointly nurtured by technology and the era, representing an important outcome in line with the development and evolution of the data era. Digital assets, as the name suggests, are digitised assets, representing a virtual, informational, non-monetary form of asset. Therefore, internationally, some accounting firms and financial institutions classify digital assets within intangible assets due to their crucial characteristic of lacking physical form. Currently, the definition of digital assets in China is described as resources digitised through electronic data entry that are legally owned or controlled by enterprises, expected to bring actual economic benefits to the enterprise in the future. According to the definition characteristics set by Guangda Bank in comparison with traditional assets, digital assets possess eight major advantages: reliance, diversity in form, shareability, zero-cost replication, processability, multiple derivations, variable value, and intangible and non-depletable nature. Consequently, digital assets, compared to traditional assets, not only enhance the operational efficiency of enterprises post digital transformation but also save significant unnecessary costs for high-tech industries. Furthermore, when enterprises categorise their internal digital assets, they can systematically classify them based on previous definitions, which can be beneficial for future valuation and classification of digital assets.

Moreover, there exist differences between the influence of ownership on traditional assets and digital assets. The value created by traditional assets remains fixed as the influence of ownership confirmed during measurement does not change due to external or artificial influences. Conversely, when confirming and measuring digital assets, the ownership influence may vary due to different users, which changes as the holder makes decisions regarding the digital assets. Therefore, adopting different methods for confirming and measuring the same assets may lead to different economic benefits for enterprises. Considering the potential security issues arising from digital risks, evaluating the definition of various assets also requires assessing the enterprise's self-risk tolerance and risk control capabilities. The form in which the asset scope is defined, whether traditional or digital, requires the management of the enterprise to make decisions that align with its future development goals based on its actual circumstances. However, in the current and future national development plans, the scope of defining digital assets will undoubtedly broaden, with more specific content paradigms, allowing different enterprises to align themselves according to different asset forms and diverse market demands. Additionally, the country strongly encourages enterprises to bravely take steps towards experimenting with feasible digital assets that have already been identified. It prioritises digital industry pilot projects for clusters of enterprises with high-tech industries, providing valuable experiences for the comprehensive digital development transformation of future enterprises and significantly reducing potential asset evaluation risks. Furthermore, standardising the definition scope of digital assets

requires joint efforts from legal policies and relevant regulatory bodies to provide secure and feasible safeguard solutions for the sustainable development strategy of digital assets in the future.

3.2 The Characteristics of Digital Assets

3.2.1 Belonging to the Category of Intangible Asset Management

Digital assets are unique in form. They share common characteristics with general intangible assets but also possess distinctive features. Digitally, they lack specific tangible form and fall within the realm of intangible asset management. However, their storage differs from traditional intangible assets. Digital assets are stored in virtual space, where the platform constructed by computer systems is virtual. Consequently, there is a possibility of technical design flaws and external hacker attacks. Moreover, the value of digital assets is perpetual, with the rapid development of the digital economy era enhancing their role and impact. Yet, due to technical instability and risks, digital assets may vanish in case of technical failure. Thus, compared to traditional intangible assets, digital assets pose significant security risks.

3.2.2 Having Enduring Reusable Value

Digital assets see an increase in value with usage. Unlike traditional assets whose value and utility decline over time, digital assets' value rises with increased usage. Compared to other asset forms, digital assets are greatly influenced by market supply and demand, leading to highly unstable transaction values. Both buyers and sellers face risks of appreciation or depreciation, but as long as digital assets exist, they do not completely vanish. Unlike typical tangible or intangible assets that may permanently lose their value due to factors like economic activities or physical losses, digital assets are intangible assets that persist within the digital asset system, especially those activated through digital accumulation like blockchain. All new digital assets stem from historical digital assets, hence their value fluctuates with changes in the digital asset chain, albeit with varying use cases, regions, and value forms.

3.2.3 Categorised as a New Type of Production Factor

Traditional production factors like labour, technology, and capital form the foundation of socio-economic development. Digital assets only become assets with investment attributes when technology reaches a certain level of development and gains recognition in the market economy. It is undisputed that digital assets represent a new mode of production. In April 2020, the Central Committee of the Communist Party of China and the State Council included data as a new type of production factor in an official document, emphasising the significance of digital assets in the new economy. Distinct from other production factors, digital assets, being products of high technology, have a broad scope in socio-economic activities, existing among production factors while influencing other factors simultaneously.

3.2.4 Functioning to Preserve and Appreciate Value

Similar to traditional assets, the value of digital assets changes over time. Overabundance of some digital assets may lead to depreciation or loss of value. However, continuously providing new meanings and functions to digital resources not only maintains but also increases their value. Storing and creating value digitally is a key objective of current digital asset management. The production cost of tangible assets increases proportionally with output, while for digital assets, costs mainly arise during the initial research and development phase, as well as sales-related expenses and other operational costs. Due to the unrestricted production of digital products, development costs are spread across products using traditional financial accounting methods, resulting in decreasing costs as sales volume rises. Compared to intangible assets, the negative value of digital assets surpasses that of intangible assets, posing greater risks in managing digital asset businesses. However, unlike traditional assets, the service potential of digital assets does not diminish with use. On the contrary, activities like merging, decomposing, analysing, and utilising digital assets often lead to increments. This added value does not reduce the service potential of the original digital assets; instead, it enhances their service potential when used in conjunction, significantly boosting their original service potential.

4 Difficulties in Digital Asset Valuation at the Current Stage

4.1 The Value of Digital Assets Fluctuates Greatly

Cryptocurrency value fluctuates significantly due to continuous processing, which can transform existing assets into new ones with a value often exceeding the sum of the original assets. Different evaluation models and methods alter the value of cryptocurrencies during processing and estimation, making valuation challenging. Innovating evaluation methods and constructing scientific models are key to controlling cryptocurrency fluctuations effectively.

4.2 The Value of Digital Assets Varies from Person to Person

The value of cryptocurrencies varies among users as different consumer groups utilise them according to their specific needs. For instance, navigation data serves diverse purposes for travellers, bike-sharing companies, and governments, leading to varying values. This diversity in usage adds complexity to cryptocurrency valuation.

4.3 The Quality of Digital Assets is the Same, but the Value of Digital Assets May Differ

Despite similar quality, the value of cryptocurrencies may differ based on individual preferences. For example, an advertisement for women's cosmetics may be highly valuable to some women but irrelevant to most men and children. This discrepancy in

perceived value emphasises the importance of considering diverse consumer perspectives during cryptocurrency valuation.

4.4 The Risk Issues Brought by Digital Assets

Cryptocurrencies pose security risks due to their close association with digital information and the internet. Inadequate data protection measures during asset valuation leave companies vulnerable to cyber threats from global hacker groups. Despite encryption measures, hackers can exploit vulnerabilities to access valuable user information, causing significant losses to businesses and customers alike.

5 Valuation Methods for Digital Assets

5.1 Cost Method

The cost method, also known as the replacement cost method, refers to the way in which assets are evaluated based on their current replacement cost after deducting various losses and depreciation. While the original cost and replacement cost are the same for a particular asset, they reflect different price levels - the original cost reflects the price level at the time of construction, while the replacement cost reflects the current price level. The cost method is straightforward in practice but has various limitations in its application, typically requiring that the assessed assets can be used continuously and that depreciation is not invalid. Assets suitable for evaluation using the cost method generally need to meet specific criteria: the purchaser does not change the asset's original purpose; the assessed asset's characteristics, structure, and functions are entirely comparable to those of the replacement asset; the assessed asset is renewable and replicable; over time, the assessed asset will depreciate, but accurately assessing replacement costs and losses is challenging. For instance, for real estate properties used over an extended period, determining their condition accurately is difficult, making it challenging to provide an accurate asset valuation using the cost method. Regarding data assets, their scope of application and the benefits generated from their use are challenging to quantify accurately, making the cost method unsuitable for assessing data assets.

5.2 Market Law

For market law to be widely applied, it is essential that China's market economy system continues to improve, providing ample space for the application of market law. Market law determines the value of the assessed assets by referencing the publicly available asset values in the market and those of similar assets, adjusting relevant factors accordingly to comprehensively establish the assessed asset's value. The effectiveness of market law depends on the presence of similar cases in the market, thus requiring a high level of market maturity. The conditions for using market law generally include active asset markets with frequent asset transactions, leading to a greater accumulation of cases for easier asset assessment using market law. Additionally, the reference objects

should have strong guiding significance for the assessed assets in terms of evaluation indicators and technical parameters.

In general, the fair value of digital assets represents the judgment of different entities based on market-specific factors regarding information resources, combining qualitative and quantitative information. The comparability of information quality features is high, and publicly transparent market transaction prices are easily accepted, demonstrating a high level of theoretical feasibility. For businesses, market law is the optimal choice for evaluating the value of digital assets, with the valuation formula as follows:

$$P = P_1 \cdot X_1 \cdot X_2 \cdot X_3 \cdot X_4 \tag{1}$$

Where P_1 represents the value of the reference object of the digital asset, X_1 represents the time difference coefficient, X_2 represents the timeliness difference coefficient, X_3 represents the development level difference coefficient, and X_4 represents the integrity difference coefficient.

5.3 Income Method

The income approach refers to discounting the future income that an evaluated asset can bring to a business in order to determine the asset's value. In comparison to the market approach and the cost approach, its most significant feature is basing the asset's value on the future value it can generate, regardless of specific costs. Therefore, it is widely used in the evaluation of intangible assets. The prerequisites for applying the income approach mainly include three points: being able to reasonably evaluate the future income of the assessed asset, being able to make a reasonable judgment on the future risks, and being able to predict the assessed asset's useful life and recovery period reasonably. When considering the issues related to digital assets discussed in this study, it is evident that there are numerous factors influencing the value and income of digital assets. Different market participants have varying understandings of the value of the same digital asset, and the value of specific digital assets may vary significantly in the hands of different entities. Therefore, the valuation of digital assets involves a high level of uncertainty, which is also why it has been challenging to establish relatively consistent research results in the field of digital asset valuation. Consequently, there are certain limitations to applying the income approach to the evaluation of digital assets. The formula for valuing digital assets using the income approach is as follows:

$$P = \sum_{i=1}^{n} \frac{R_i}{(1+r)^i} + \frac{S}{(1+r)^n} \tag{2}$$

In the formula, n represents the discounting years of digital assets, Ri represents the return of the i-th period, r represents the discount rate, and S represents the future residual value of digital assets or the return when disposing of digital assets in the n-th period.

6 Conclusion

Digital assets have their own unique charm, bringing subtle changes to various industries in today's era of rapid digital transformation. Therefore, when considering the industrial transformation of traditional Chinese enterprises into digital assets, it is essential to handle the potential detailed issues in digital asset valuation with great caution, given the unique nature of digital assets and the existing difficulties in valuation abroad. However, this does not hinder China's supportive attitude towards enterprises entering the digital asset market for future industrial transformation, provided that they adhere to existing accounting standards and legal principles. Bold exploration and experimentation are encouraged, paving the way for a better understanding of the future direction of the digital asset market and the establishment of a sound basis for regulating accounting standards and legal frameworks related to digital assets. Furthermore, it is crucial to enhance the standards of digital asset valuation within the defined boundaries, with the goal of providing more impetus for China to become a world-class digital powerhouse.

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