Strategic Report

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Digital assets: Speculative bubble or real revolution? Part 2/3.
The fundamental value

Highlights

- Among the different models proposed to assess the fundamental value of digital assets, three main categories stand out: (1) models that focus on a comparison with commodities; (2) approaches that focus on the ability of digital assets to act as currency; and (3) the comparison between digital assets and a safe haven such as gold.
- The commodity comparison approach is to determine value based on production costs. However, this approach ignores key concepts of digital assets. In particular, the validation mechanisms of the blockchain adapt to the number of players in the network which means that the price of the asset does not influence supply, unlike commodities.
- The monetary theory angle focuses on the original goal of cryptocurrencies, i.e., a currency that simplifies transactions between individuals. However, this model requires calibration of several complex parameters such as velocity of the cryptocurrency. Small variations on these parameters can lead to large variations in the calculated fundamental values.
- Of all the methods discussed for assessing the fundamental value of cryptocurrencies, the comparison with gold is probably the one most often mentioned. Due to the concept of digital scarcity associated with cryptocurrencies, their total market value is compared to the total market value of gold. However, this valuation is based on the assumption that gold and digital assets are equivalent assets. Nothing could be less certain. First, gold is a real asset that has been used for thousands of years. Secondly, gold has attractive properties that have been proven in inflationary or crisis situations, which justifies its status as a store of value. These same properties have not yet been demonstrated by cryptocurrencies that aspire to become digital gold.
- Any attempt at valuation must clearly distinguish digital assets from blockchain technology. While it is tempting to conflate blockchain and digital assets, it is important to remember their fundamental values are distinct and often nebulous!

Christophe Faucher-Courchesne
Associate, Quantitative Strategy
CIO Office

Nicolas Charlton
Associate, Quantitative Strategy
CIO Office

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Recap

The first strategic report dedicated to digital assets (which include cryptocurrencies such as bitcoin) presented the origin and mechanisms surrounding this asset class that was borne out of the desire to improve transaction efficiency. It has been established that digital assets are based on a decentralized database. The network is operated through a series of mathematical steps that identify the initiator of a transaction. The database is updated by a validation mechanism that can take the form of proof-of-work or proof-of-stake. It is this second component that is the main innovation of cryptocurrencies. Indeed, blockchain is seen by some as a technology that can have a major impact in several areas. Although there is now a wide variety of networks with various mechanisms and associated digital assets, their characteristics compared to conventional systems generally fall into three categories: (1) the ability to settle complex transactions quickly and cheaply; (2) digital scarcity; and (3) the ability to create smart contracts.

Different approaches

What is the fundamental value of the various digital assets that have these characteristics? This is a very complex question. Unlike stocks, bonds or commodities which are valued using widely accepted models related to their intrinsic characteristics, digital assets are not yet mature enough to allow a model to prevail. In addition, other imponderables such as regulatory considerations further complicate the valuation. Nevertheless, the characteristics of the asset necessarily influence the choice of model. The objective of this report is not to propose a more appropriate approach, but rather to overview the important considerations when valuing digital assets and to illustrate the wide range of fundamental values that can be obtained.

Among the different models proposed for valuing fundamental values, three main categories stand out, in no particular order: (1) models that focus on a comparison with commodities; (2) approaches that focus on the ability of digital assets to act as money; and (3) the comparison between digital assets and a safe haven such as gold.

The commodities approach

A first approach is to compare digital assets to commodities, which implies a relationship between price and production costs. Indeed, it might be tempting to compare the miners of digital asset networks to commodity producers. For these commodities, the price influences the number of producers. When the price of a commodity increases, more producers begin to manufacture that commodity as different fabrication mechanisms become profitable. Conversely, when the price decreases, the number of producers also decreases, reducing supply until a new equilibrium is reached. Digital asset miners face energy consumption costs to validate transactions due to the complex mathematical problems that must be solved with the proof-of-work mechanism. It is therefore possible to think that the number of miners would decrease if these costs became too great relative to the potential reward of obtaining new cryptocurrency units. However, this approach ignores several essential components of the validation mechanism.

Recall that the difficulty of the mathematical problem in the Bitcoin network automatically scales with the number of miners, so that a transaction block always takes about ten minutes, on average, to validate. This means the price of the asset does not influence the supply, and the cost of production adapts according to the number of producers rather than the other way around. One should also remember that the principle of digital scarcity stems from the fact that the quantity of cryptocurrency issued when transactions are validated (and, therefore, the value of the reward, all other things being equal) is programmed to decrease over time. These unique characteristics of digital assets distance them considerably from the dynamics of commodities and make use of production costs to determine fundamental value highly questionable.

Table 1 Comparison between theory of money and digital asset valuation

Variable	Theory of money	Digital assets
M	Total money supply	Market capitalization
V	Velocity	Velocity
P	Price of goods and services	Transaction value
Q	Quantity of goods and services	Number of transactions

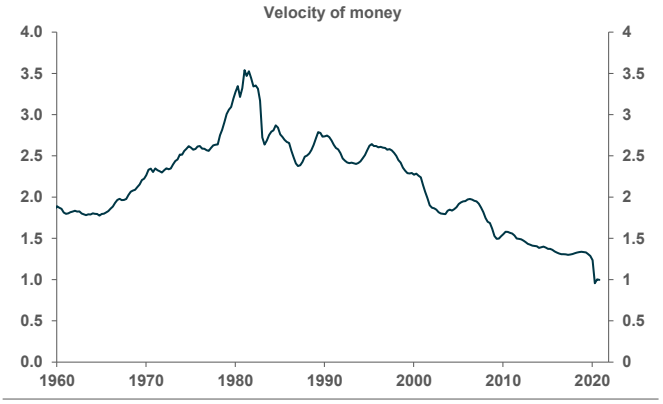
Finally, it should be emphasized that production costs and the prices that can be derived from them are only meaningful if consumers have a real need for these assets. Otherwise, regardless of production costs, demand and price could be zero. This consideration is relevant for digital assets, as a more efficient network could quickly become a substitute for another network that would see its value melt away, regardless of production costs.

The theory of money approach

The monetary theory angle is another approach used in determining the fundamental value of cryptocurrencies. Cryptocurrencies like bitcoin were initially intended to be an alternative to conventional currencies. Indeed, recall that the initial article of Bitcoin aimed to solve the barriers involved in transfers between clients of different financial institutions or different countries. A model to determine the value of a currency could therefore be relevant to assess the fundamental value of a digital asset aimed at providing an alternative solution. In monetary theory, the exchange equation formulated by Irving Fisher relates the monetary supply *M*, the velocity of the currency *V* (the frequency with which the currency changes hands), the price of goods and services *P*, and the quantity of goods and services *Q,* according to the following equation MV = PQ (**Table 1**).

If *V*, *P* and *Q* are known, then it is possible to determine the value of the monetary supply *M*. By dividing this value by the number of bitcoins in circulation, it is possible to determine the fundamental value. However, this model has two weaknesses. First, it is only rational to apply this model if the digital asset actually behaves like currency. The observed high volatility of the value of bitcoin and the limitations of the network in terms of the number of transactions that can be processed do not support this argument. Second, the estimation of the various parameters is complex. For example, the velocity of the currency is not constant over time. The U.S. Federal Reserve tracked the velocity of the U.S. dollar between 1959 and 2021 and observed a value that varied between 0.96 and 3.54 (**Chart 1**).

1 | Velocity, an unstable value



CIO Office (data via the Federal Reserve Bank of St. Louis)

It is quite possible that the digital assets used as currencies show at least as much variation in velocity. The determination of value by this model is therefore of limited interest. As an example, let's assume a *P* value of $750, which is about the median value in Canadian dollars of a bitcoin transaction in the last year. Let's also assume 300 million transactions per year (or about 10 transactions per second for a year). Based on these values and the observed velocity range of the U.S. dollar, the fundamental value of a bitcoin would range from about $3,000 to $24,000 (**Table 2, next page**).

Table 2 Bitcoin's fundamental value according to the monetary theory approach

P*	Q	V	M	Fundamental value**
$750	300 000 000	0.5	$450 000 000 000	$23 684
		1.0	$225 000 000 000	$11 842
		1.5	$150 000 000 000	$7 895
		2.0	$112 500 000 000	$5 921
		2.5	$90 000 000 000	$4 737
		3.0	$75 000 000 000	$3 947
		3.5	$64 285 714 286	$3 383

*Data via bitinfocharts.com. **Based on 19 000 000 coins circulating in the market

The safe-haven approach

Of all the methods debated to assess the fundamental value of cryptocurrencies, the comparison with gold is probably the one most often mentioned. Due to the concept of digital scarcity associated with cryptocurrencies, the total value of their market is compared to the total value of the gold market. This position is explained by the law of one price, an economic principle which states that two equivalent assets should have the same value. However, there is some debate about the size of the gold market to be considered (**Table 3**). Should only gold used for investment be considered? Should we also include government reserves and gold used in industrial and jewelry contexts?

If we consider only the market for gold used for investment purposes, which is a market of C$3.507trillion, and a market of C$2.251 trillion for digital assets, the total value is $5.758 trillion. If gold and digital assets were to split the two markets equally, digital assets would represent a market of $2.879 trillion. This amount varies greatly, however, depending on the proportion of the market attributed to digital assets (**Table 4, next page**).

This valuation assumes that gold and digital assets are equivalent assets. Nothing could be less certain. First, gold is a real asset that has been used for thousands of years. Secondly, gold has attractive properties that have been proven in inflationary or crisis situations, which justifies its status as a store of value. These same properties have not yet been demonstrated by cryptocurrencies that aspire to become digital gold.[1]

Relative valuation

Such an approach allows for a comparison between the market of digital assets serving as a store of value but does not allow for a comparison of the value of digital assets among themselves. It can therefore be interesting to compare the level of adoption of digital assets between them in order to arrive at a relative valuation of digital assets. In this case, the comparison is usually based on the number of users. Digital assets require a network of users, not only to hold the assets but also to validate transactions. Therefore, some propose to borrow an empirical model called Metcalfe's Law. Metcalfe's Law states that the utility of a network is proportional to the square of the number of its

Table 3 Gold markets

Purpose	Value* (B)	Market share
Jewellery	$7,289	46%
Investment asset	$3,507	22%
Central bank reserves	$2,669	17%
Industrial applications	$2,371	15%

*At CA$2 400 per gold ounce. Data via gold.org

[1] Correlation and other properties of digital assets in portfolio construction will be discussed in the next strategy report on this topic.

Table 4 Cryptocurrencies fundamental value based on the safe-haven approach

Gold held as investment asset (B)	Cryptocurrencies market cap. (B)	Total safe haven assets (B)	Cryptocurrencies total market share	Fundamental value (B)
$3,507	$2,340	$5,848	1%	$58
			10%	$585
			25%	$1,462
			50%	$2,924

Data via Refinitiv, gold.org

users. This law is sometimes used to compare different social media. Indeed, when the number of users in a network doubles the number of possible links between the different participants is multiplied by four.

Analogous with this law, which is sometimes used to compare different social media, some argue it is possible to compare the adoption of digital assets based on the number of users. This model may be relevant for comparing the adoption of different digital assets on a relative basis, but it does not allow one to determine the monetary value of each. Another important limitation is that this model ignores the relative importance of each user. Indeed, the number of participants who can validate transactions (miners, in the case of Bitcoin) plays an important role in the efficiency of the network. Moreover, the relative importance of different participants in the same network is not taken into account.

Non-fungible tokens

These models are mostly tailored to the core values of cryptocurrencies. However, cryptocurrencies are not the only digital assets. The non-fungible tokens (NFTs) that have recently gained popularity also capitalize on the concept of digital scarcity but have distinct characteristics from cryptocurrencies. As the name implies, these assets are not interchangeable, unlike cryptocurrency coins of a given network. Therefore, it is not necessarily desirable to apply one valuation model to this entire subclass of digital assets, but better to apply a valuation specific to each possible token. These tokens are digital evidence of ownership. The underlying object is then potentially more significant in determining fair value than the medium of evidence of ownership itself. For example, a non-fungible token of a work of art is valued differently than an NFT of a web domain name. That being said, proof of ownership is still significant in assessing value, as the value associated with ownership only exists if the market recognizes that ownership. The IT environment makes this highly questionable.

NFTs are particularly developed in the art market. For example, in March 2021, the auction house Christie's sold a digital work of art for US$69 million.[2] The certificate of ownership and authenticity was issued as an NFT. However, these digital works are images sometimes accessible for free on the Internet. One can rightly question the real value of a property associated with an asset that is freely accessible.

Digital assets vs. blockchain

For both cryptocurrencies and NFTs, it is important to distinguish between the value of digital assets and the technology value of the underlying blockchain, as the appreciation of the value of one does not necessarily impact the other. This means that the assessment of the fundamental value of digital assets must be decoupled from the technology on which it is based. For example, potential innovations associated with blockchain could disrupt certain markets and generate opportunities. However, these opportunities would not necessarily translate into an increase in the fundamental value of digital assets such as bitcoin although based on this same technology.

[2] JPG File Sells for $69 Million, as 'NFT Mania' Gathers Pace, 25 mars 2021.

Conversely, the rise in popularity of digital assets is not evidence that blockchain will enable revolutions in many sectors. This situation is not unlike the advent of the Internet, for a variety of reasons.

The Internet has enabled a host of new opportunities and market disruptions. Who could have foreseen thirty years ago that it would be possible to access an artist's entire musical repertoire or to rent a foreigner's apartment for the duration of a trip with just a few clicks? However, the cash flows generated by these activities do not belong to the Internet per se, but rather to the companies exploiting the capabilities of the Internet. Moreover, not all companies with an Internet-based business model benefit from the operating profits of other Internet-based companies. In the case of blockchain, it is difficult to predict whether these disruptions will materialize and to identify which sectors will be impacted. Beyond these uncertainties, a company generating profits from blockchain is not a rational argument to support a rise in the price of digital assets independent of that company.

Conclusion

In conclusion, the method of assessing the fundamental value of an asset must be related to the characteristics of the asset. The characteristics of digital assets are not yet well established due to their novelty, so there is no standard for assessing their fundamental value. Comparison to commodities, monetary theory models, and the safe-haven market approach are three categories of models proposed to assess the value of cryptocurrencies. Slight variations in the assumptions surrounding these models, however, can greatly vary the fundamental value, making any prediction risky.

Any valuation attempt must clearly distinguish the digital asset from the blockchain technology. While it is tempting to conflate blockchain and digital assets, it is important to remember that their fundamental values are distinct and very often nebulous!

The ultimate question for an investor is whether these assets should be considered in the portfolio construction process. In an attempt to shed some light on this question, the next report will discuss the historical properties of digital assets, the impact of including them in a typical portfolio, and the relevant considerations associated with portfolio construction.

CIO Office
CIO-Office@nbc.ca

Martin Lefebvre
Chief Investment Officer
martin.lefebvre@bnc.ca

Louis Lajoie
Director
Investment Strategy
louis.lajoie@bnc.ca

Simon-Carl Dunberry
Director
Portfolio Strategy
simon-carl.dunberry@bnc.ca

Nicolas Charlton
Associate
Quantitative Strategy
nicolas.charlton@bnc.ca

Mikhael Deutsch-Heng
Associate
Investment Strategy
mikhael.deutschheng@bnc.ca

Zaid Shoufan
Associate
Portfolio Strategy
zaid.shoufan@bnc.ca

Christophe Faucher-Courchesne
Associate
Quantitative Strategy
christophe.faucher-courchesne@bnc.ca

General

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