

A Primer On Valuing Cryptocurrencies

By **Simona Mola and An Wang** (April 16, 2018, 1:29 PM EDT)

Startups and projects raised \$5.6 billion through initial coin offerings last year[1] and are keeping up the pace in 2018.[2] At the beginning of this year, the aggregate market capitalization of cryptocurrencies hit an all-time high of more than \$800 billion in early January, before severely falling.[3] Despite the recent significant drop in value, some foresee that the cryptocurrency market will hit the \$1 trillion mark in 2018.[4]

The increasing popularity surrounding cryptocurrencies has fostered much legal debate. It appears that, when it comes to cryptocurrencies, there are more questions than answers. Is a cryptocurrency a “currency” or a “security”? Would all ICOs and simple agreements for future tokens, or SAFTs,[5] be considered securities offerings? Would tokens issued pursuant to a SAFT be considered securities? Would tokens issued as securities ever stop being securities?

While regulators have not officially provided a definitive answer to these questions, there is no doubt that cryptocurrencies have attracted attention, judging from the enforcement actions taken in recent months.[6] In January, the chairmen of the U.S. Securities and Exchange Commission and the U.S. Commodity Futures Trading Commission drafted a joint op-ed published in *The Wall Street Journal* announcing that the two agencies will work together, along with other federal and state regulators and criminal authorities, to bring transparency and integrity to the cryptocurrency markets.[7] They also vowed to support policy efforts to revisit existing regulatory frameworks and ensure that they are effective and efficient for the digital era.

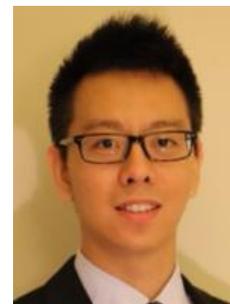
As more legal clarity unfolds, we would like to contribute to the debate by offering an economic perspective on cryptocurrencies. Our main question is: What drives the value of a cryptocurrency? This article offers some initial answers. However, not all cryptocurrencies are created equal from an economic standpoint, and understanding their differences has crucial implications on their valuation.

What Is Cryptocurrency?

Cryptocurrency is commonly defined as a digital asset designed to work as a medium of exchange that uses cryptography technology, with the most well-known cryptocurrencies being bitcoin and ether.[8] However, the umbrella term “cryptocurrency” conceals important differences in the role



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cryptocurrencies play in their ecosystems, which consist of the underlying technology, the network (also called “platform”), and the applications on the network.

First, the underlying technology is called blockchain. Analogous to anti-counterfeiting and ledgering technologies used for the circulation of fiat currency, blockchain allows tamper-proof “book-keeping” via shared ledgering in a network. Blockchain records and shares information of all transactions across the entire network, with each transaction being a block and each block connected to the one before and after, forming an irreversible chain. With this structure, no single individual can alter a transaction that has already occurred, and all transactions are validated before being permanently recorded by all network members, achieving lower human error, fewer inconsistencies and disputes, and higher security and efficiency.[9]

Second, analogous to how internet technology is used to build websites and networks, the blockchain technology can be used to build platforms for a variety of purposes serving different industries (e.g., finance, supply chain, health care, hospitality, etc.). Bitcoin and ethereum are only two examples of blockchain networks. In both networks, transactions happen directly between users without the need of an intermediary. Started around 2009, bitcoin is the first blockchain network that functions as a decentralized digital payment system operating without a centralized administrator or a central bank.[10] Introduced around 2015, the ethereum platform is another blockchain network whose structure allows realizations of diverse functionalities through various applications.[11] The table below lists five key features of blockchain technology that translate in the characteristics of the networks for various uses.

Blockchain Features		
General Features	Bitcoin and Ethereum Networks	Other Blockchain Networks for Business
Digital	Coins, tokens and all transaction records are digital	Records of all actions/transactions every step along the supply chain are digital
Distributed ledger	Information of all transactions are shared among all anonymous participants on the network	All information of all transactions is shared among all approved participants on the network
Networkwide validation	Transactions are validated by miners before being recorded	Transactions are validated by all parties involved before being recorded
Chronological and time-stamped	Post-validation, transactions are recorded as a block and are time-stamped to form a chain	Post-consensus, transactions are recorded as a block and are time-stamped to form a chain
Cryptographically locked	Blocks are cryptographically locked to be irreversible, making it impossible to counterfeit coins or reverse transactions	Blocks are cryptographically locked to be irreversible, making it impossible to counterfeit or tamper with business records

Last, developers build applications that operate on blockchain platforms to realize various functionalities. While the bitcoin network functions solely as a digital payment system, the ethereum platform is different in that it allows developers to build applications with diverse functions. For example, Golem is an application on the ethereum platform acting like an “Airbnb for computers,” where requestors for computing power can find providers from around the globe via the ethereum network.

In their ecosystems, digital currencies play different roles. While bitcoin is the only coin circulated in the bitcoin network, the ethereum network allows many tokens to circulate, with ether being the primary coin.[12] Primary coins are introduced into their respective ecosystems through “mining” — a process where miners validate each transaction and store them all in a blockchain structure. On the ethereum network, developers of applications create a fixed total supply of secondary coins that are convertible to the primary coin ether[13] and distribute them through ICOs. Investors pay ether to obtain the tokens. Imagine ether is your dollar bill, and secondary coins are movie tickets or gift cards. You use dollars to purchase tickets and then use the tickets to enter certain theaters, or use dollars to purchase gift cards and shop in particular stores.

Secondary tokens are typically introduced into their ecosystem via ICOs rather than through mining. They are convertible to their respective primary coins and are used to purchase services and functionalities provided by specific applications. Secondary tokens are usually of two varieties: usage tokens and work tokens.[14] Usage tokens act like a foreign currency used in the respective application “country.”[15] Golem Network Token, or GNT, is a perfect example of usage token because a requestor of computing power in Golem needs to use GNT or convert ether into GNT. Work tokens, in contrast, establish a shareholding sort of relationship between investors and the respective applications, in which token holders have a say in the direction that application takes. Decentralized Autonomous Organization tokens (DAO tokens) are examples of work tokens. If you hold a DAO token (e.g., DigixDao Token, or DGD), you have the right to vote and determine the best way forward for the DAO.[16] The table below summarizes the categorization of coins and tokens.

Categorization of Cryptocurrencies		
Category	Subcategory	Example(s)
Primary	--	Bitcoin, Ether
Secondary	Usage token	Golem Network Token, EOS, TRON
	Work Token	DigixDAO, Aurora DAO

Valuation of Cryptocurrency

To this day the valuation of cryptocurrency is largely an open question, not only because all coins or tokens have subtle differences in their functionalities, but also because the underlying technology and platforms are extremely hard to evaluate on a monetary basis. This article does not venture to provide a survey of valuation techniques for cryptocurrency but rather offers some initial answers.

Given the various types of coins, there is no overarching set of theories that guide valuation. One needs to carefully look at the structure of a given application and the usage of a given token to estimate its value. As a general guideline, from an economic point of view, we can broadly categorize cryptocurrencies into three groups: currency tokens, utility tokens and application tokens.[17]

Currency tokens offer functionalities similar to fiat currency as unit of accounting, means of exchange, and storage of value. They are supplied to their monetary system through a process called “mining.” Miners utilize their computing powers to solve mathematical puzzles to release coins into the system, which takes increasingly more time per coin as the stock of coins increase. Bitcoin is an example of a currency token. From an economic perspective, such tokens have more features of currencies than securities, although the collective efforts of developers of the network, the mobile applications, the user interfaces, etc. do play a role in the acceptance of a currency token. For example, if digital wallets were user-unfriendly, would there be as many bitcoin holders as there are? One way to value a currency token is to look at factors economists often use to evaluate fiat money, i.e., money supply and the growth of the economy. For example, around 21 million bitcoins in total can be mined — that’s the supply. The demand, however, is less tangible and depends on many factors, including regulation, usage and popularity of the coin, and people’s outlook of its commercial usage.

Utility tokens are more complicated to value, as they compound a “currency” component and a “utility” component. Ether is an example of a utility token, as it facilitates the performance of all functions realized in the ethereum network, very much like how gas and electricity powers your car and PlayStation. For ether, unlike bitcoin, there is no known cap on supply. As the mining of ether continues, more “money” is supplied into the system. The demand for ether depends on both the currency component and the utility component. The currency component, as discussed above, depends on many factors like regulation, popularity, usage and trust in the “money.” The latter is even harder to fathom, as the demand of ether depends collectively on the variety of functionalities, customer experience, and services of the applications running on the ethereum platforms.

Application tokens can be viewed as utility tokens stripped off the currency component; i.e., application tokens do not have universal acceptance in a given network. GNT or DAO tokens are examples of application tokens, for they are built on top of a utility token and designed for specific applications. For example, GNT is an application token used in Golem. To switch from holding GNT to DAO token, investors need to convert GNT to ether and then buy DAO tokens with ether. In most applications, the supply of the token is given, which narrows down the supply side of the analysis. The demand side depends on the quality, popularity, customer experience and the potential of the application. If the demand of the service provided by Golem is expected to grow rapidly, the ether value and the dollar value of GNT will certainly rise. For work tokens like DAO tokens, the expected future returns to investors also factor into the value of the respective tokens. Given the growing amount of application tokens introduced via ICOs in the recent years, benchmark analysis can be implemented to assess the value of a token of interest by comparing the fundamentals of the application to a comparable one.

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[1] Oscar Williams-Grut, “Only 48% of ICOs Were Successful Last Year — But Startups Still Managed to Raise \$5.6 Billion,” Business Insider, Jan. 31, 2018.

[2] Allen Scott, "ICOs Raised over \$1 Billion in 2018, and It's Only February," Bitcoin News, Feb. 26, 2018.

[3] See Cryptocurrency Market Capitalization, accessed April 9, 2018.

[4] Ryan Browne, "Cryptocurrency Market Will Hit \$1 Trillion Valuation This Year, CEO of Top Exchange Says," CNBC, Feb. 13, 2018.

[5] Juan Batiz-Benet, Jesse Clayburgh and Marco Santori, "The SAFT Project: Toward a Compliant Token Sale Framework," Cooley, Oct. 2, 2017.

[6] See Cybersecurity Enforcement Actions, accessed April 9, 2018.

[7] Jay Clayton and J. Christopher Giancarlo, "Regulators Are Looking at Cryptocurrency," Wall Street Journal (Jan. 24, 2018).

[8] Panos Mourdoukoutas, "Bitcoin, Ethereum, and Litecoin Are the Most Popular Cryptocurrency Investments among Millennials," Forbes, Mar 25, 2018.

[9] Manav Gupta, Blockchain for Dummies (IBM limited edition). (Hoboken, NJ: John Wiley & Sons, Inc., 2017).

[10] Ameer Rosic, "What Is Bitcoin? A Step-by-Step Guide for Beginners Guide," accessed March 29, 2018.

[11] Ameer Rosic, "What Is Ethereum? A Step-by-Step Beginners Guide," accessed March 29, 2018.

[12] A special feature of cryptocurrencies like bitcoin and ether is their extremely high fragmentation, i.e., the ability to break the minimum unit of 1 cent. For example, the smallest unit of bitcoin is a satoshi, one hundred millionth of a single bitcoin, and the smallest unit of ether is a wei, one quintillionth (ten to the power of negative eighteen) of a single ether.

[13] Coins and tokens are sometimes used interchangeably, although there is a tendency in the cryptoworld to refer to primary coins as coins and to application-specific, secondary coins as tokens.

[14] Ameer Rosic, "What Is an Ethereum Token? The Ultimate Beginner's Guide," accessed March 29, 2018.

[15] We understand that the SAFT project and its proposed protocol focus on what we refer here as usage tokens, which are further categorized in prefunctional and already-functional tokens based on the timing of the realization of the application. The value of the tokens at the prefunctional stage depends predominantly on the expectation of developers' efforts, while the value of the tokens at the already-functional stage is likely determined by a variety of market factors that dominate the developers' efforts.

[16] Securities and Exchange Commission, "Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO," Release No. 81207 (July 25, 2017).

[17] Phil Glazer, "The Different Categories of Cryptocurrencies," Hackernoon, Jan. 31, 2018.