21SHARES

ISSUE 7

STATE OF CRYPTO

Our insights into valuation frameworks, the case for cryptoassets.

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Foreword

This report provides an in-depth overview of the state of the cryptoasset industry over the last few months — offering our view on the industry and a recap of the most important news items. In addition, we have included one of our research reports: Our insights into Valuation Frameworks, *The Case for Cryptoassets*.

We hope our writing and research can guide you over the next few months by helping you better understand the cryptoasset industry.

State of Crypto

Executive Summary

Valuation Methodologies: First, we introduce the two broad types of valuation approaches: (1) Fundamental or Intrinsic valuation composed of the Discounted Cash Flow (DCF) method and Mining Production Cost. (2) Relative valuation composed of Multiples and Market Sizing.

Valuation methods depend on the type of cryptoassets: Both fundamental and relative valuations can be applied to all cryptoassets but should differ and adapt to (1) The type of consensus mechanism: Proof-of-Work versus Proof-of-Stake — and (2) The type of token: Governance, Utility tokens, and NFTs.

Proof-of-Work Assets: The Mining Production Cost is an important fundamental metric for solely Proof-of-Work assets like Bitcoin. Market sizing and multiples also apply to Bitcoin.

Proof-of-Stake Assets, Governance Tokens, and NFTs: Investors may value Proof-of-Stake cryptoassets like Ethereum and Governance tokens, including MakerDAO, using an intrinsic valuation computed with a DCF method.

Additionally, investors may value all cryptoassets, including NFTs, with relative valuation methods, such as Multiples and Market Sizing.

Limitations of valuation methods: The report concludes with the limitations and shortcomings of cryptoasset valuation methods, including bias, uncertainty, and complexity.

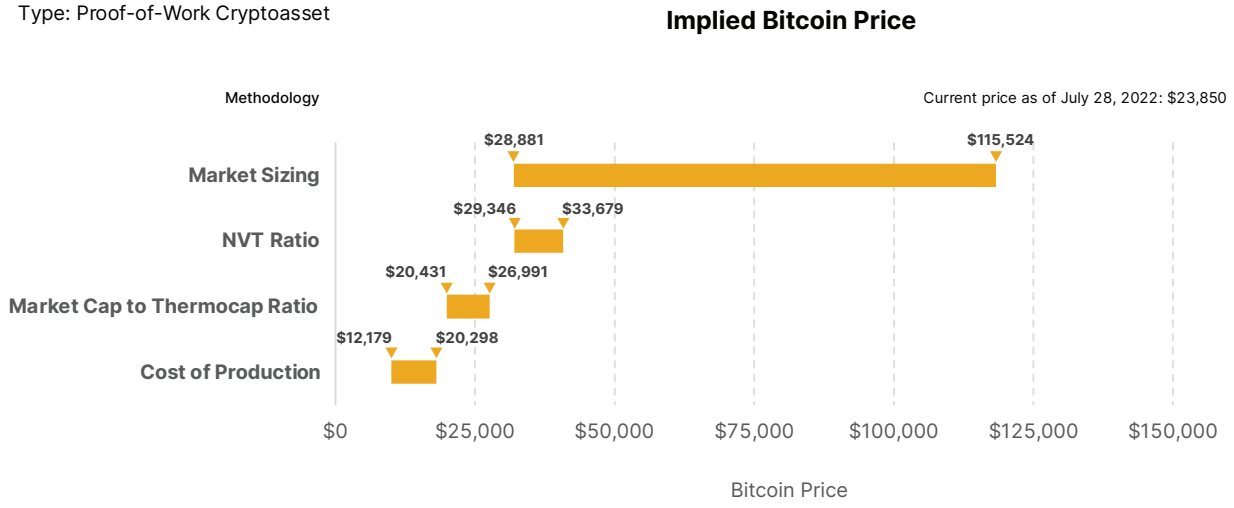
Source:
21Shares

	Valuation Approaches	Intrinsic		Relative		
	Asset Superclasses	**Capital Assets** "Crypto-capital"	**Consumable/ Transformables** "Crypto-commodities"	**Capital Assets** "Crypto-capital"	**Consumable/ Transformables** "Crypto-commodities"	**Store of Value Assets** "Cryptocurrencies and Collectibles"
Infrastructure Layer	**Proof of Work** (e.g. Bitcoin)		• Cost of Production (Mining)		• NVT Ratio, • Price-to-Utility • Market Cap / Thermocap • Market Sizing	• Market Sizing
Infrastructure Layer	**Proof of Stake** (e.g. Ethereum, Solana)	• Discounted Cash Flow (DCF) Valuation		• Price-to-Sales • Price-to-Earnings • Market Cap / TVL • Price-to-Utility • Market Sizing		
Application Layer	**Governance Tokens** (e.g. Uniswap, Aave)					
Application Layer	**Utility Tokens** (e.g. Chainlink)				• NVT Ratio • Market Cap / TVL • Market Sizing	
Application Layer	**NFTs** (e.g. BAYC, CryptoPunks)					• Fine Art Assessment • Market Sizing

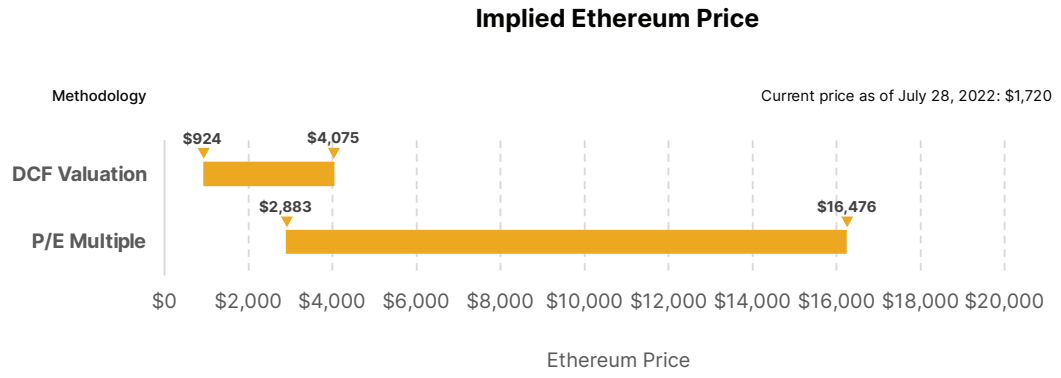
Figure 1:
Valuation Price Ranges of Bitcoin, Ethereum, and MakerDAO

Source:
21Shares

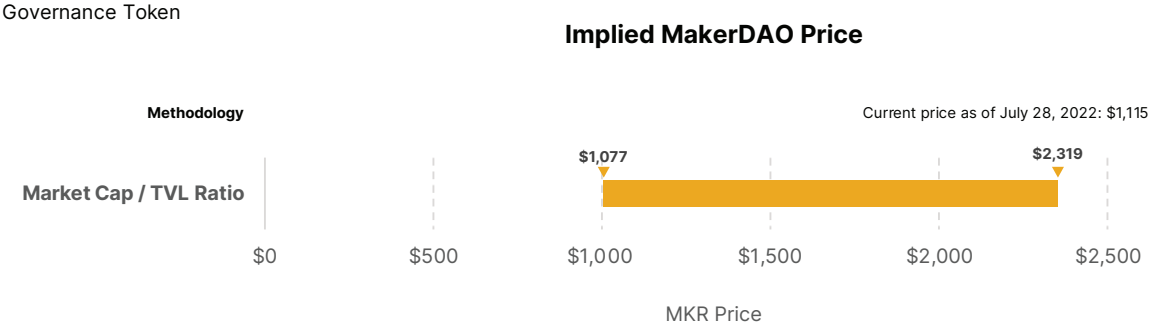
Asset: Bitcoin
Type: Proof-of-Work Cryptoasset



Asset: Ethereum
Type: Proof-of-Stake Cryptoasset[1]



Asset: MakerDAO
Type: Governance Token



[1] Post-Merge

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Introduction

We are thrilled to release the update of our valuation framework report published in September 2020. In two years, the cryptoasset industry grew by over 194%, from $390 billion to more than $1.1 trillion in market value.

Despite the tumultuous first half of 2022 with macro uncertainty and implosions of a handful of crypto protocols, lenders, and funds — our optimism and thesis remain unchanged. The recent turn of events in crypto will lay more robust risk management practices and infrastructure to onboard billions of people in the next few years. We believe crypto will disrupt and expand business models in financial services, eCommerce, art, music, and more. However, we are still in the early innings of this innovation, created by just 0.06% of the world's developers and accessed by less than 5% of the global Internet population or circa 300 million users.

Valuing crypto remains a subject necessitating industry-wide consensus, and frameworks must adapt to this fast-paced asset class that is offspringing emerging use cases. This new State of Crypto release serves as a guide combining and building upon previous efforts to develop a fundamental framework for cryptoassets. Our goal is to propose valuation methodologies that reconcile different approaches investors have taken in recent years.

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About Our Research

21Shares is the world's leader in providing access to crypto through simple and easy-to-use products — co-founded by Hany Rashwan and Ophelia Snyder.

The Research team is a cross-functional department collaborating with the distribution, product, and engineering teams. Composed of professionals with more than 8 years of experience in the cryptoasset industry, our team places education at the core of our industrial research as we stand by free and publicly accessible content; and strongly believe information asymmetry contradicts crypto ethos and philosophy. We provide data-driven, cutting-edge, unique insights into the crypto markets and macroeconomic factors likely to influence the state of this industry.

More than 10,000 investors read our research notes and reports on a weekly basis, ranging from private banks, asset managers, professional traders, hedge funds, tier-1 media outlets, and regulators.

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Company's Update

21Shares and ETF Securities Launch the World's First Bitcoin and Ethereum ETFs in Australia: *April 19, 2022* – 21Shares and the leading ETF provider, ETF Securities have launched two funds that offer simple, cost-effective and direct access to cryptocurrency investments. ETFS 21Shares Bitcoin ETF is the first Australian ETF to invest directly in bitcoin, and ETFS 21Shares Ethereum ETF is the first to invest directly in ether.

21Shares Launches BOLD, the World's First Bitcoin and Gold ETP: *April 27, 2022* – 21Shares announced the listing of the 21Shares ByteTree BOLD ETP (BOLD) on SIX Swiss Exchange, the world's first ETP that combines Bitcoin and Gold. BOLD has been developed in partnership with ByteTree Asset Management, a UK specialist provider and manager of alternative investment strategies. BOLD's core investment objective is to deliver protection against inflation via optimized risk-adjusted exposure to Bitcoin and Gold with assets weighted in inverse proportion to their risk.

Investing in the DeFi Revolution: 21Shares Launches Layer 1 and DeFi ETPs: *May 12, 2022* – 21Shares announced the launch of the new 21Shares Layer 1 and 21Shares DeFi 10 Infrastructure ETPs on SIX Swiss and BX Swiss Exchange, respectively. Both of these new products allow investors to invest in the services and technical fundamentals of the DeFi industry.

21Shares Enters US Market with Launch of Two Crypto Index Funds: *May 18, 2022* – 21Shares US Advisers LLC, an affiliated entity of 21Shares marked its entrance into the US market with the launch of two private funds: 21Shares Crypto Basket 10 Index Fund and 21Shares Crypto Mid-Cap Index Fund, which seek to track the performance of the "Vinter 21Shares Crypto

Basket 10 US Index" and "Vinter 21Shares Crypto Mid-Cap US Index," respectively. Composed of several of the world's largest cryptocurrencies by market capitalization, both funds will be rebalanced and reconstituted quarterly to reflect the dynamic nature of the crypto space. As of today, accredited U.S. investors can invest in the funds.

21Shares Launches USDY, the World's First USD Yield ETP: *May 25, 2022* – 21Shares announced the listing of the 21Shares USD Yield ETP (USDY). USDY provides collateralized dollar-denominated yield at the rate of 5%. USDY generates yield by taking in US dollars and lending them to counterparties against a minimum of 110% collateral in BTC and ETH marked-to-market daily. The yield is generated by lending USD to well known counterparties in the crypto space.

21Shares Announces Crypto Winter Suite: *June 29, 2022* – 21Shares announced its Crypto Winter Suite – a set of products designed to help investors weather the bear market. The first product introduced in the suite is the 21Shares Bitcoin Core ETP (CBTC), the world's cheapest physically-backed Bitcoin ETP, which launched on SIX Swiss Exchange.

21Shares Unveils S&P Risk Controlled Bitcoin and Ethereum Index ETPs: *July 20, 2022* – 21Shares announced the listing of two new ETPs on SIX Swiss Exchange to offer investors exposure to the largest cryptocurrencies – Bitcoin and Ethereum – while targeting less volatility. These two ETPs are the latest products in 21Shares' Crypto Winter Suite – a set of products designed to help investors weather the bear market.

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Market Updates

Business

Justice Sun launched **USDD**, Tron's algorithmic stablecoin backed with $10B of crypto in collateral.

Fidelity announced plans to start allowing investors to put a Bitcoin account in their 401(k)s by the end of 2022.

Emirati real estate tycoon **Damac** started accepting Bitcoin and Ethereum directly for purchases of its properties.

Yuga Labs launched a sale of virtual land related to its highly anticipated metaverse project, raising $320M worth of crypto.

Jane Street took out a $25M USDC loan through the institutionalized **Clearpool** protocol.

Coinbase recorded a $430M losses in Q1 2022.

Terra's native currency LUNA crashed to zero, and its algorithmic stablecoin UST drifted farther from its peg at $0.09. **Terra Luna Classic** project launched two weeks later to replace what was Terra Luna with LUNAC as the new token.

McKinsey predicted that the metaverse industry could reach $5 trillion by 2030.

Three Arrows Capital got liquidated for $400M, facing a liquidity crisis and dragging Genesis and Voyager down.

Circle introduced **$EUROC**, an ERC-20 Euro-backed stablecoin, fully backed by euro-denominated reserves held in the custody of regulated financial institutions.

Polygon, **Solana**, and mobile company **HTC** launched three different phones that grant easy access to Web3 tools.

FTX finalized the deal with **BlockFi** on a $400M revolving credit facility and an option to acquire BlockFi at a variable price of up to $240M.

Aave introduced **GHO**, a decentralized, yield-generating stablecoin, with the collateral being supplied by users who wish to mint GHOs.

Reddit launched "**Collectible Avatars**," an NFT marketplace for avatars on Polygon.

Celsius filed for bankruptcy with a $1.2B deficit, and **Voyager** asked for bankruptcy permission to release funds from the custodian to honor customer withdrawals.

Investments

Dapper Labs, developers of Flow blockchain, raised $725M from **Andreessen Horowitz**, **Digital Coin Group**, and others to fund blockchain growth.

Aurora launched a $90M fund to finance DeFi apps on **Near** protocol.

Goldman Sachs and **Barclays** joined a $70M Series A funding round in UK crypto trading platform **Elwood**.

Binance Labs raised $500M to invest in Web3 and made a strategic investment in **PancakeSwap**'s utility and governance token CAKE.

Cronos ecosystem launched a $100M fund for DeFi and Web3.

Ledger and **Cathay Innovation VC** launched a $110M crypto fund to invest in Web3 startups.

Solana Ventures set up a $100M fund for GameFi and DeFi in South Korea.

VeChain entered a $100M partnership with **UFC** to support their marketing growth.

Huobi launched s $1B investment arm dubbed **Ivy Blocks**, which focuses on DeFi and Web3.

Immutable launched a $500M developer and venture fund to accelerate the adoption of Web3 games and projects.

MachineFi Labs, core dev of IoTeX, raised $50M, allegedly setting the company's valuation at $100M.

Solana NFT marketplace **Magic Eden** raised $130M at a valuation of $1.6B.

Goldman Sachs was raising a $2B fund to buy **Celsius**'s assets in case it went bankrupt.

MakerDao looking to invest $500M in 80% treasuries and 20% bonds to utilize untapped reserves.

Animoca, **WeMade**, **Samsung Next** back **Planetarium Labs**, a Web3 studio, to develop open-source games.

Multicoin Capital raised $430M for its **Venture Fund III** eyeing crypto projects demonstrating what they call "proof of physical work," creating economic incentives for permissionless contribution.

Regulations

New York State Assembly passed a bill to impose a two-year moratorium on Proof-of-Work mining operations that rely on carbon-based fuel.

Argentina banned unregulated crypto transactions in traditional banks.

Germany exempted BTC and ETH individual owners from paying taxes if they sold their holdings after a year.

Crypto.com received provisional approval from **Dubai Virtual Assets Regulatory Authority**. While the **SEC** investigated **Binance**'s native token **BNB** for potential violation, the crypto exchange got accused of being a conduit for the laundering of at least $2.35B in 5 years.

NY regulator released stablecoin guidance with strict reserve and attestation requirements.

Japan passed a bill limiting stablecoin issuers to banks and trusted companies only.

Jamaica made **Jam-Dex**, a central bank digital currency (CBDC), a legal tender.

With a hash rate of 0.12%, **Iran** pulled the plugs on authorized crypto mining facilities.

The **UK government** has amended controversial plans for crypto transfers and information sharing.

Cardano pitched to **Congress** a software-enabled self-regulation system that automatically monitors compliance until an anomaly is encountered.

Albania announced it will tax investment income derived from cryptoassets by 15% in 2023.

Huobi crypto exchange won licenses in **Dubai** and **New Zealand**.

BitMEX banned **Russian citizens or residents** from accessing services from the European Union as of July 5.

India crypto volume slumped after introducing a **30% income tax** and a **1% tax per transaction on crypto trades**.

US Treasury developed a legal framework for **international crypto regulation**.

UK Court allowed serving legal documents to anonymous person(s) connected to two digital wallets through an NFT drop to wallet addresses.

Russia passed a bill into law **banning digital assets** as payments.

EU officials finalized the Markets in Crypto-Assets (**MiCA**) framework, an agreement on what is likely to be the first major regulatory framework for the cryptocurrency industry.

Technology

Polkadot launched a new cross-chain communication protocol, **XCM**, secured at the same level as Polkadot's core hub, the Relay Chain.

Solana suffered from two outages this quarter; one for 7 hours due to unprecedented bot demand on the NFT project **Candy Machine**, and the other for 4.5 hours due to some traffic on the network.

Bancor V3 went live with instant impermanent loss protection, dual rewards, and auto compounding features.

PancakeSwap switched from an unlimited supply model to a capped supply at 750M $CAKE.

Cloudflare announced it will run Ethereum Proof-of-Stake validator nodes to serve as a testing ground for research on energy efficiency, consistency management, and network speed.

BNB Chain unveiled its technical roadmap that includes sidechain, metaverse, and increasing the number of validators to 41. The network later launched a decentralized applications platform with **'Red Alarm'** to warn users about scams.

Ethereum's **Merge** arrived at **Ropsten Testnet**, Ropsten Beacon chain was updated on June 2. **The Merge** will focus on Goerli or Sepolia for the post-merge context. Rinkeby, Ropsten, and Kiln will be shut down.

Terra Bridge V2 went live; users were able to transfer assets to and from Terra 2.0, Ethereum, Osmosis, Secret, Cosmos, and Juno.

Block subsidiary TBD announced plans to build "**Web5**," a new decentralized web centered around Bitcoin for identity management.

Ava Labs launched a contest calling for written developer tutorials for Subnets. **Avalanche** also released Core wallet, which allows native Bitcoin to bridge over to the network.

Double protocol launched **EIP 4907**, the newest standard facilitating the NFT rental market, separating NFT ownership, use rights, and automatic recovery.

Tornado Cash made its UI open source.

Sudoswap released **sudoAMM** for trading NFTs; users could gradually buy or sell NFTs, provide liquidity, and trade with a lower fee.

A report by security firm **CertiK** showed that social media is a 'major Web3 pain point' as phishing attacks increased by 170% in 2022.

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Glossary

An **Automated Market Maker (AMM)** is an automated decentralized exchange where trades are made against a pool of tokens called a liquidity pool. An algorithm regulates the values and prices of the tokens in the liquidity pool.

A **Blockchain** is an append-only, decentralized ledger that can be used to store data (such as transaction history) in a censorship-resistant way.

Bridges allow independent blockchains to communicate with each other for the transfer of assets or messages.

Cryptoassets are digital assets whose global transaction history is stored on a blockchain.

A **Crypto Exchange** is a platform that enables the exchange of cryptoassets for other crypto assets or fiat currencies.

A **Decentralized Autonomous Organization (DAO)** is an organization managed by members often using open source code and smart contracts, decisions are often voted upon by members and utilize a native token for participation.

A **Decentralized Exchange (DEX)** is a platform for buying, trading, and selling digital assets, directly and peer-to-peer on the blockchain without a centralized intermediary.

A **Digital Wallet** is software that interacts with blockchains to facilitate the storage of cryptoassets.

Ether (ETH) is the native crypto asset of the Ethereum blockchain and is used to pay for the transaction and smart contract fees on the network.

A **Halving Event** is when the number of new coins awarded to miners per block is cut in half.

The **Hash Rate** is the combined number of computations (hashes) performed by all miners within a network per second.

Liquidity Mining is the process where traders often provide assets to a specific pool to earn fees or rewards.

Mining is a mechanism where individuals within a network solve computationally difficult proofs of work to confirm transactions and add new blocks to a blockchain.

A **Non-Fungible Token (NFT)** is a unique cryptographic token that is not interchangeable with any related asset and can not be divided or altered.

On-chain refers to information and transactions that are executed and stored explicitly on a blockchain.

Proof of Stake (PoS) is a mechanism that selects block creators based on a participant's stake, such as the number of tokens they hold or how long they have participated on the network.

A **Proof of Work (PoW)** is a piece of data that is difficult to produce but easy for others to verify and satisfies certain requirements. They are often used in the consensus mechanisms of crypto asset networks.

A **Rollup** is an off-chain aggregation of transactions to be processed off-chain before on-chain settlement and is often considered a throughput solution.

A **Smart Contract** is digital code typically programmed onto a blockchain that enforces a previously agreed-upon transaction based on preset conditions.

Stablecoins are cryptoassets that aim to have similar volatility to widely-used fiat currencies like the US dollar.

Staking is the process of locking up tokens in order to verify transactions on the blockchain and earn rewards.

Total Value Locked (TVL) is a DeFi native metric that measures the crypto assets locked in decentralized finance (DeFi) protocols through the use of smart contracts or assets under management.

Zero-Knowledge Proofs (ZKPs) is a cryptographic method that enables an individual to prove to a verifier that a certain asset or information exists without revealing details about the asset or information itself.

Valuation Frameworks

Valuation Approaches

Valuation in crypto remains an emerging topic seeking consensus, especially as the asset class expands in use cases. Starting with basics, the answer to "what's the value of an asset?" is two-fold per Aswath Damodaran, professor of finance at the Stern School of Business at New York University:

1. **Intrinsic or Fundamental Valuation:**

   The value of an asset as it relates to its fundamentals, namely ongoing cash flows, expected growth, and risk. An intrinsic valuation is computed with a Discounted Cash Flow (DCF) method, where the value of an asset is the net present value (NPV) of expected future cash flows, adjusted for timing and risk.

2. **Relative Valuation:**

   The value of an asset is compared to a group of assets or a single asset in a similar market segment. A relative valuation is much more likely to reflect market perceptions and sentiment than a fundamental valuation.

   There are two main methods to compute a relative valuation:
   - *multiples – a standardized estimate of a price.*
   - *market sizing — an estimation of the target market, also called total addressable market (TAM).*

Important to note that Professor Damodaran described these two approaches for companies. Although cryptoassets are not companies, the same general principles resonate with crypto – and any other investable asset class. This framework helps navigate this new asset class by leveraging traditional valuation methodologies.

Table 1:
Comparison between Intrinsic and Relative valuation approaches

Source:
21Shares

	Intrinsic Valuation	**Relative Valuation**
Definition	Relates the value of an asset to its capacity to generate cash flows, adjusted for timing and risk.	How much to pay for an asset based upon what others are paying for comparable assets.
Methods	Discounted Cash Flow (DCF)	Multiples (a standardized estimate of price), Total Addressable Market (TAM)
Market Exposure	Less exposed to market sentiment and perceptions.	In sync with market sentiment and perceptions.
Complexity	Requires more explicit inputs and information, which are difficult to estimate.	Requires less explicit information than a discounted cash flow (DCF) valuation.
Fundamentals	Forces investors to think about an asset's fundamentals.	Assets that seem undervalued on a relative basis may still be overvalued on a fundamental basis.
Limitations	Only assets that generate cash flows can be valued using this approach.	Any asset can be valued using this approach.

Table 1 highlights the distinction between fundamental and relative valuations. In the following section, we propose a simple taxonomy of cryptoassets to give a better sense of the differences we may expect in valuation approaches.

Valuation Frameworks

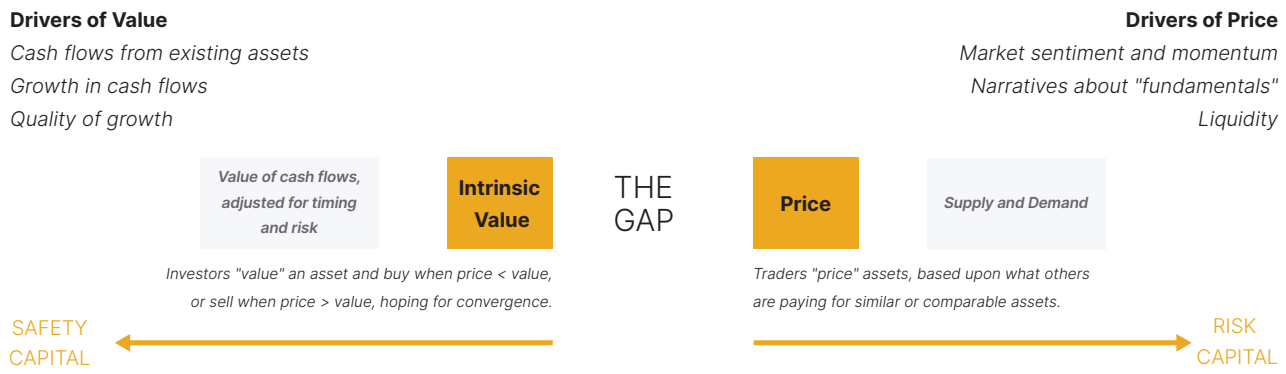
Price and Value Discrepancies

The one thing all valuation approaches have in common is the presumption that markets are inefficient, at least in the short term. Otherwise, price would be the best estimate of value, and there would be no point in valuing an asset. In this regard, Damodaran draws a clear distinction between value and price:

- **Value** is driven by fundamentals including cash flows, growth, and risk.
- **Price** is driven by market sentiment, narratives, and liquidity.

Figure 2: Price and Value Discrepancies

Source: 21Shares based on Damodaran[2]



Regarding valuation approaches, intrinsic valuations focus almost exclusively on the asset's fundamentals, excluding market dynamics. In contrast, relative valuations are more perceptive to market sentiment and momentum. Thus, they can help gauge if: (1) an asset is undervalued relative to its peers and (2) if the asset is historically overvalued or undervalued based on indicators such as the price-to-sales ratio (P/S ratio).

[2] https://aswathdamodaran.blogspot.com/2022/07/risk-capital-and-markets-temporary.html

In this regard, market cycles can be viewed as a constant fluctuation between "safety" and "risk" capital (see Figure 2).

- When risk capital is abundant, it kickstarts periods of "irrational exuberance", and asset prices soar to relatively high levels.
- Investors will avoid riskier ventures when risk capital is absent, and everyone seeks safety.
- Greer[3] argues that assets that lack an objective measure of value and have a constraint on supply are more vulnerable to irrational exuberance, citing the dot-com bubble as an example.
- Cryptoassets lack an objective measure of value today among investors, similar to emerging tech companies in the late 1990s. As such, they tend to be "priced" by traders and bid up to unsustainable levels when risk capital is abundant.

[3] The superclasses of assets revisited, Robert Greer. http://www.jpmcc-gcard.com/wp-content/uploads/2018/11/Page-62_67-Winter-2018-GCARD-Greer.pdf

Valuation Frameworks

The Taxonomy of Cryptoassets

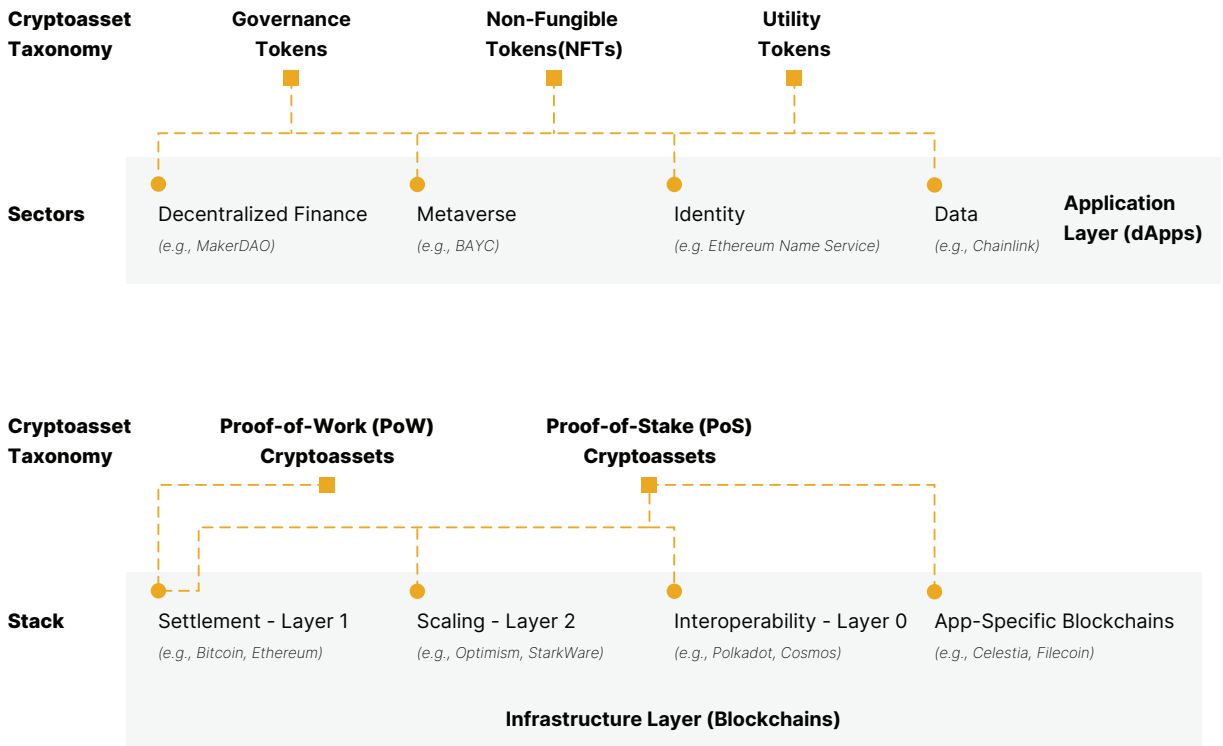
In traditional finance, an investor will value companies with some variation of a DCF method because it is a known fact that common stock represents a residual claim to a company's ongoing or future profits.

In addition, suppose the same investor was deliberating on whether or not to buy a piece of fine art. In this case, it obviously wouldn't make sense to use a DCF valuation, as there are no cash flows to discount. Instead, it is a known fact that individuals value collectibles based on their subjective beliefs and preferences.

Similarly, we must delineate a taxonomy of cryptoassets to understand the differences we may expect in the value accrual and potential valuation approaches. We propose five types of cryptoassets, as shown below.

Figure 3: Taxonomy of cryptoassets

Source: 21Shares



At the infrastructure layer, we propose categorizing cryptoassets based on the consensus mechanism of the blockchain[4]:

1. **Proof-of-Work (PoW) Cryptoassets:** The native asset is not one of the inputs of block production. Instead, PoW relies on a computationally and energy-intensive lottery called mining to determine which block to add and reward the miners.

2. **Proof-of-Stake (PoS) Cryptoassets:** Validators must commit a portion of their capital (the "stake") to gain access to a recurring value stream generated by the network's rules.

At the application layer, we propose the following labels:

3. **Governance Tokens:** Governance tokens yield voting rights and represent ownership of the application.

4. **Non-Fungible Tokens (NFTs):** NFTs are unique tokens that are not interchangeable with any related asset. This characteristic is in contrast to cryptoassets like Bitcoin (BTC) and Ethereum (ETH), which are fungible in nature.

5. **Utility Tokens:** Tokens granting access to the products or services of an application and intended to be used within the blockchain's network, rather than serve as an investment.

[4] Same approach used by Burniske. See Section 3, Asset Superclasses.

Valuation Frameworks

Asset Superclasses

Since the late 1990s, investable asset classes, including equities, bonds, currencies and precious metals, have followed a superclass framework pioneered by Robert Greer's paper, "*What is an Asset Class Anyway?*". Professor Greer argued that there are three asset superclasses: Capital Assets, Consumable Assets and Store of Value Assets. In this regard, it's arguably relevant to categorize cryptoassets within these superclasses.

1. **Capital Assets (CA):** "An ongoing source of something of value." Most obvious examples include equities and bonds.
2. **Consumable/Transformable Assets (C/T):** "You can consume it. You can transform it into another asset. It has economic value. But it does not yield an ongoing stream of value." Examples include physical commodities like grain or energy products.
3. **Store of Value Assets (SoV):** "They cannot be consumed, nor can they generate income. Yet they do have value." Examples include currencies and collectibles, such as fine art.

While there are only three investable asset superclasses, there are subsets of these classes, each with its own set of risk factors, as shown in Figure 2. In his 2019 work[5], Chris Burnsike divided cryptoassets into two groups based on their consensus mechanism at the infrastructure layer (See Figure 3):

- **Proof-of-work (PoW) cryptoassets** belong to the Consumable/Transformable class, as they essentially create "a digital native commodity in the form of secure, globally accessible ledger space."
- **Proof-of-stake (PoS) cryptoassets** require ownership of the native asset to gain access to a recurring value stream generated by the network. PoS assets are productive and fall in the Capital Asset category. Their value may be derived from the net present value of annual flows to validators. In other words, investors can value PoS cryptoassets using a DCF valuation.

In our view, some confusion regarding cryptoasset valuations stems from the fact that cryptoassets seem to encompass characteristics of all three asset superclasses: Capital Assets, Consumable/Transformable Assets and Store of Value Assets. We will address this concern in the following section, but for now, suffice it to say that a DCF valuation is the most appropriate method to value PoS cryptoassets.

- In contrast, for PoW cryptoassets, we may use the mining production cost as a price floor estimate.
- For both PoW and PoS cryptoassets, we may also use relative valuations to price them in the context of market sentiment and momentum.

[5] https://www.placeholder.vc/blog/2019/4/26/value-capture-and-quantification-cryptocapital-vs-cryptocommodities

Figure 4:
Asset superclasses and their traditional subsets

Source:
https://ark-invest.com/articles/analyst-research/bitcoin-new-asset-class/

	Capital Assets	Consumable / Transformable Assets	Store of Value Assets
Equities	+	–	–
Bonds	+	–	–
Income-Producing Real Estate	+	–	–
Physical Commodities (e.g. grains or energy)	–	+	–
Precious Metals (e.g. gold)	–	+	+
Currency	–	–	+
Fine Art	–	–	+

Figure 5:
Asset superclasses and their cryptoasset subsets

Source:
21Shares

	Capital Assets "Crypto-capital"	Consumable / Transformable Assets "Crypto-commodities"	Store of Value Assets "Cryptocurrencies and Collectibles"
PoS Cryptoassets	+	–	–
Governance Tokens	+	–	–
Utility Tokens	–	+	–
PoW Cryptoassets	–	+	+
NFTs (Collectibles)	–	–	+

Regarding the application layer:

- **Governance tokens** are analogous to common stock in traditional finance, so they fall in the Capital Asset class.
- **Utility tokens** drive the economics of the system as their sole function, meaning they fall in the Consumable Asset category.[6]
- **NFTs** are essentially collectibles like fine art in their current form[7], so they fall in the Store of Value category.

"To reiterate, the key differentiator boils down to whether the internal asset of the system must be staked to participate; if it must, then that asset is a requisite to receive value flows, and it becomes a capital asset. If the internal asset is not one of the inputs to production, then it's likely we have a crypto-commodity on our hands."

- Chris Burniske

[6] Some utility tokens, such as The Graph's GRT, generate cash flows for token holders. In these instances, utility tokens could be considered capital assets and valued using a DCF method. Thus, the most significant difference between utility and governance tokens is that the latter yields voting rights on the platform and represents ownership of the protocol, while the former does not.

[7] NFTs can encompass a plethora of use cases outside collectibles. For example, "royalty-generating NFTs" can be used by artists to sell their content directly to their fans. Because they generate cash flows, royalty-generating NFTs are capital assets. There are also "redeemable NFTs," representing ownership of real-world items, such as deeds to a car. Redeemable NFTs are consumable/transformable assets.

Valuation Frameworks

Fundamental Valuation

This section delves into the rationale as to why a DCF model applies to PoS cryptoassets and governance tokens while the mining cost of production sets a floor price for PoW cryptoassets.

Proof-of-Stake Cryptoassets

Two schools of thought emerged with regards to PoS cryptoassets: Blockchains as Businesses (BaB) and Blockchains as Nations (BaN)[8].

- Blockchains as Business (BaB) advocates place more weight on token value accrual than the utility of the network as whole.
- Blockchains as Nations (BaN) aficionados deem native tokens as the unit of account of an ecosystem akin to the legal tender of a sovereign nation. For instance, NFTs within the Ethereum ecosystem are priced in ETH, and users must pay a fee denominated in the native token every time they perform a transaction.

Capital Assets	↔	**Blockchains as Businesses (BaB)**
C/T and Store of Value Assets	↔	**Blockchains as Nations (BaN)**

Both philosophies have part of the truth, but neither has it all because PoS blockchains are at the same time both like businesses and nations. Most smart contract platforms, scaling solutions, and interoperability protocols implement a PoS consensus mechanism. As such, they require ownership of the native token to gain access to a recurring value stream generated by the network. From the standpoint of a staker, the cryptoasset becomes akin to a stock that pays an annual dividend yield, which means we can conduct a discounted cash flow (DCF) valuation.

In general, we need the following information to value a PoS cryptoasset using this approach:

1. **Estimate the cash flows** during the life of the cryptoasset.
2. **Estimate the lifespan** of the cryptoasset.
3. **Estimate the discount rate** to apply to these cash flows to get the net present value (NPV).

[8] Credit to Nick Holtz for this framing in his article "Are blockchains businesses or nations?" which summarizes the dialogue between both approaches. https://www.ar.ca/blog/are-blockchains-businesses-or-nations

1. **Estimate the cash flows during the life of the cryptoasset:** The "dividend yield" in a company is equivalent to the staking yield in a PoS cryptoasset, which in most cases is determined by the following three variables:

    a. **Transaction fees** within the network accrue to stakers. Just so, BaB advocates view fees as a proxy for revenue.

    b. **Token issuance** doesn't dilute the value of stakers. On the contrary, stakers have the right to new issuance, similar to how shareholders may receive stock-based compensation.

    c. **The number of staked tokens** as a percentage of the total circulating supply will determine the staking participation rate. Other things equal, an increase in the staking participation rate will cause a decrease in the staking yield and vice versa.

Having laid out these variables, we may construct the subsequent formulas:

Annual cash flows to validators (CF) *= Transaction Fees (a) + Token Issuance (b)*

Staking Yield (Y) *= Annual cash flows to validators (CF) / The Number of Staked Tokens (c)*

As mentioned previously, carrying out a DCF valuation also requires two more quintessential variables:

2. **Estimate the lifespan of an asset:** With public companies that at least in theory can last forever, equity analysts generally assume that cash flows beyond a specific point in time continue in perpetuity. Arguably, investors may apply the same logic to PoS cryptoassets, so they may, for instance, estimate future cash flows for ten years and assume that they will continue in perpetuity beyond that point.

3. **Estimate the discount rate to get the net present value using the Capital Asset Pricing Model (CAPM):** The discount rate should reflect the risk perceived by the marginal validator in the PoS blockchain. Thus, the discount rate should be consistent with the asset's risk profile and can be thought of as the expected rate of return of the marginal investor. While no model will perfectly quantify risk, investors should be aware of the biases and limitations of each model to choose the one that best aligns with their needs. The most straightforward approach is to use the Capital Asset Pricing Model (CAPM), which Nobel laureate Harry Markowitz introduced in 1952 and is the most widely used risk measure today among traditional investors:

$$\textit{Expected Return} = E(R) = R_f + \beta(R_m - R_f)$$

Where R_f is the risk-free rate, β is the beta relative to market portfolio, and Rm is the market risk premium.

The Fama and French Three-Factor Model: More sophisticated investors could go a step further and use the Fama and French Three-Factor Model, which expands on the CAPM by adding size and value risk factors to the market risk factor. This model was developed by Nobel laureates Eugene Fama and his colleague Kenneth French in 1992. Similar to the CAPM, the procedure for estimating betas and computing the expected return in the

Fama French model is to regress the historical returns of the asset against three factors — (1) market premium, (2) size premium, and (3) value premium:

Figure 6: Fama and Fench Three Factor Model

Source: Investopedia

$$R_{it} - R_{ft} = \alpha_{it} + \beta(R_{Mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t$$

where:

R_{it} = Total return of asset i at time *t*

R_{ft} = Risk-free rate of return at time *t*

α_{it} = Intercept of the regression (i.e., excess return of the asset or alpha)

R_{Mt} = Total market portfolio return at time *t*

$R_{it} - R_{ft}$ = Excepted excess return

$R_{Mt} - R_{ft}$ = Excess return on the market portfolio

SMB_t = Size premium (small minus big)

HML_t = Value premium (high minus low)

β_{123} = Factor coefficients

With these variables in mind, we arrive at the following equation to determine the "intrinsic" value of the cryptoasset:

$$\text{Value of asset} = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \frac{CF_4}{(1+r)^4} \ldots + \frac{CF_n}{(1+r)^n}$$

where CF_t is the expected cash flow in period t, r is the appropriate discount rate given the riskiness of the cash flow, and n is the life of the cryptoasset.

Ethereum DCF Valuation

We will apply the DCF valuation methodology proposed above to Ethereum, the largest network in terms of daily revenue (average of $2.8 million in August, 2022). But first, it's worth providing a brief recap of The Merge. Ethereum's main chain currently runs on a PoW consensus mechanism but will soon merge to a fully-fledged Proof-of-Stake network. PoS will eliminate the need for energy and computationally-intensive mining, relying instead on staked ETH to secure the network. From an investor's perspective, ETH will become a capital asset when The Merge takes place — tentatively in September of this year.

Moving on to the valuation,

Step 1:

We can divide the total revenue Ethereum validators will accrue into two segments: (a) transaction fees of the network and (b) token issuance.

(a) Fees: Ethereum's cumulative revenue through transaction fees in the past year stands at **$8.47 billion**[9].

(b) Issuance: Currently, mining rewards amount to ~13,000 ETH per day. However, post-Merge, mining rewards will disappear, and staking rewards will amount to ~1,600 ETH per day[10], which translates to an annual staking issuance of ~584,000 ETH (1,600 × 365 days). At ETH's current price ($1,720) as of July 28, validators would perceive about **$1 billion** in revenue through issuance alone.

(c) Total Cash Flows: With the above estimates, we could assume that annualized cash flows to validators will amount to **$9.47 billion (a + b)** in year 1.

[9] Source: TokenTerminal, as of Jul 28, 2022

[10] https://ethereum.org/en/upgrades/merge/issuance/

Step 2:

Calculate the expected future cash flows and life of the cryptoasset. We propose a slight variation of the three-stage growth model to project Ethereum's future cash flows. As such, we forecast an initial period of very aggressive growth, followed by a period of incremental decrease that eventually stabilizes at a more moderate growth rate. For example, if we believe that ETH's life will be 20 years, we can consider the following growth rate in revenue[11]:

Table 2: Ethereum's Three-Stage Growth Model

Source: 21Shares

Aggressive Growth		Incremental Decrease		Stabilization	
Year	Annual Growth	Year	Annual Growth	Year	Annual Growth
2022	**40%**	2027	**30%**	2036	**15%**
2023	**40%**	2028	**30%**	2037	**15%**
2024	**40%**	2029	**30%**	2038	**15%**
2025	**35%**	2030	**30%**	2039	**10%**
2026	**35%**	2031	**25%**	2040	**10%**
		2032	**25%**	2041	**10%**
		2033	**25%**		
		2034	**25%**		
		2035	**20%**		

Step 3:

Estimate the discount rate to apply to these cash flows to get the net present value (NPV). We used five years of daily data (July 2017 - June 2022) to calculate a lower and upper bound of the expected rate of return based on the Fama and French Three-Factor Model. We have also included the traditional CAPM in Table 3 as a reference for investors that might prefer a more straightforward approach. The lower bound discount rate (17.6%) takes into account the risk-free rate (10 Year Treasury Yield as a proxy) and Fama and French's three factors (market premium, size premium, and value premium). Then, we add ETH's expected excess return (alpha[12]) to the lower bound to estimate the upper bound discount rate. If investors incorporate "alpha" into the formula, the expected rate of return would be 35.5%.

[11] This may seem too aggressive for some investors, but Ethereum's revenue increased ~1,600% and ~1,500% in 2020 and 2021, respectively, so this is actually a conservative estimate based on historical performance. This being said, current market conditions could cause a decrease in year-over-year revenue in 2022, but we try to exclude market sentiment and momentum from the DCF analysis, assuming that over the long term, future growth rates will offset cyclical variations.

[12] The standard procedure for estimating betas is to regress cryptoasset returns (Rj) against market returns (Rm), (Rj = a + b Rm) where "a" the intercept and "b" is the slope of the regression – investors can interpret "a" as the expected excess return of the asset in question, while "b" represents the beta.

Table 3:

Fama and French Three-Factor Model Applied to Ethereum (Historical Data from 31/07/2017 - 30/06/2022)

ETH Price	ETH Return	Date	Alpha	Mkt-RF	SMB	HML	RF
200.94		31-Jul-17					
225.91	11.71	1-Aug-17	1	0.24	-0.18	0.15	0.004
217.79	-3.66	2-Aug-17	1	-0.08	-1.17	0.15	0.004
224.68	3.11	3-Aug-17	1	-0.21	-0.33	-0.31	0.004
219.53	-2.32	4-Aug-17	1	0.25	0.3	0.38	0.004
269.59	20.54	7-Aug-17	1	0.16	-0.1	-0.57	0.004
296.08	9.37	8-Aug-17	1	-0.24	-0.06	0.25	0.004
295.03	-0.36	9-Aug-17	1	-0.14	-0.76	-0.06	0.004
297.86	0.95	10-Aug-17	1	-1.49	-0.31	0.26	0.004
309.28	3.76	11-Aug-17	1	0.19	0.24	-0.87	0.004
299.27	-3.29	14-Aug-17	1	1.03	0.29	0.11	0.004
286.55	-4.35	15-Aug-17	1	-0.11	-0.85	-0.02	0.004
301.18	4.97	16-Aug-17	1	0.18	-0.13	-0.44	0.004
299.9	-0.43	17-Aug-17	1	-1.6	-0.17	-0.16	0.004
292.27	-2.58	18-Aug-17	1	-0.15	0.12	0.24	0.004
321.72	9.6	21-Aug-17	1	0.06	-0.24	-0.22	0.004
313.61	-2.56	22-Aug-17	1	1.06	-0.02	-0.24	0.004
317.08	1.1	23-Aug-17	1	-0.33	0.09	0.42	0.004
325.07	2.48	24-Aug-17	1	-0.14	0.59	0.17	0.004
329.55	1.36	25-Aug-17	1	0.18	0.12	0.55	0.004
347.68	5.35	28-Aug-17	1	0.08	0.34	-0.74	0.004
372.39	6.86	29-Aug-17	1	0.1	0.13	-0.39	0.004
383.4	2.91	30-Aug-17	1	0.53	0.01	-0.31	0.004
388.37	1.28	31-Aug-17	1	0.62	0.48	-0.43	0.004
391.31	0.75	1-Sep-17	1	0.27	0.41	0.4	0.005
1,191.13	-2.15	27-Jun-22	1	-0.28	0.54	1.24	0.003
1,142.74	-4.15	28-Jun-22	1	-2.1	-0.35	2.36	0.003
1,098.80	-3.92	29-Jun-22	1	-0.2	-0.44	-1.3	0.003
1,070.15	-2.65	30-Jun-22	1	-0.95	0.43	-0.15	0.003

Source:

21Shares, French and Fama data:

https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research

	Fama and French Expected Daily Parameters			
	Alpha ff	b mkt	b smb	b hml
	0.0716	1.3625	0.421	-0.1036

Risk-Free 10 Year Treasury Yield	2.68%

Market Beta according to CAPM	1.3989	
Alpha accoring to CAPM	**17.23%**	Alpha is the intercept of of the regression of ETH return's against (mkt - rf) returns

Market beta according to Fama and French	1.3625	
Annualized (Mkt-rf)	11.14%	
Annualized (SMB)	-1.06%	
Annualized (HML)	-1.68%	
Annualized Alpha according to Fama and French	**17.90%**	Alpha is the intercept of of the regression of ETH return's against Fama French 3-Factors

	r	
Fama and French 3-Factor Model	**17.60%**	= Rf + b1 (Mkt-rf) + b2 smb + b3 hml
CAPM	**18.30%**	= Rf + b (Mkt-rf)

	r + ETH Expected Excess Return (Alpha)	
Fama and French 3-Factor Model	**35.50%**	= Alpha + Rf + b1 (Mkt-rf) + b2 smb + b3 hml
CAPM	**35.50%**	= Alpha + Rf + b (Mkt-rf)

Step 4:

Finally, we can estimate the net present value (NPV) of cash flows using the above parameters:

Table 4:
ETH Discounted Cash Flow Valuation (DCF)[13]

Source:
21Shares

		Ether Supply	119,869,673.14
#	**Year**	**Annual growth**	**Revenues**
1	2022	**40%**	$9,473,888,409.00
2	2023	**40%**	$13,263,443,772.60
3	2024	**40%**	$18,568,821,281.64
4	2025	**35%**	$25,996,349,794.30
5	2026	**35%**	$35,095,072,222.30
6	2027	**30%**	$47,378,347,500.10
7	2028	**30%**	$61,591,851,750.14
8	2029	**30%**	$80,069,407,275.18
9	2030	**30%**	$104,090,229,457.73
10	2031	**25%**	$135,317,298,295.05
11	2032	**25%**	$169,146,622,868.81
12	2033	**25%**	$211,433,278,586.01
13	2034	**25%**	$264,291,598,232.52
14	2035	**20%**	$330,364,497,790.65
15	2036	**15%**	$396,437,397,348.77
16	2037	**15%**	$455,903,006,951.09
17	2038	**15%**	$524,288,457,993.75
18	2039	**10%**	$602,931,726,692.82
19	2040	**10%**	$663,224,899,362.10
20	2041	**10%**	$729,547,389,298.31

Discount Rate	NPV (Market Cap)	Price per ETH
17.58%	$488,475,711,787.33	**$4,075.06**
35.48%	$110,739,419,663.86	**$923.83**

Results:

Assuming a discount rate of 17.58%, the implied price per one ETH today would be $4,075.06, a ~137% increase from ETH's current price ($1,720). On the other hand, if we use a 35.48% discount rate, the implied price per one ETH would be $923.83. Investors should interpret the results of this DCF valuation with caution and run their own assumptions regarding projected cash flows and discount rates. For instance, one could argue that our discount rates are too high, which evidently lowers the expected NPV. However, the rationale behind our approach was to be conservative and capture the high volatility of ETH in the discount rate to reflect the asset's riskiness accurately. Another implicit assumption of this approach is that the asset's monetary premium (SoV) is embedded into the DCF[14].

[13] At an average gas price of at least 16 gwei, at least 1,600 ETH is burned every day, which effectively brings net ETH inflation to zero or less post-merge. https://ethereum.org/en/upgrades/merge/issuance/

[14] By definition, PoS requires validators to commit a portion of their capital ("the stake") to propose and validate new blocks. Thus, one could argue that stakers must believe in the long-term prospects of the asset as a store of value.

Governance tokens

What are Governance tokens?

Governance Tokens give token holders voting powers for proposals and changes to the underlying protocol. Investors could compare them to common stock in traditional finance, where stockholders can elect the board of directors and vote on corporate governance. In theory, they also represent a residual claim to a protocol's ongoing and future profits. Some governance tokens accrue a percentage of the platform's revenue, which allows investors to compute the "intrinsic" value of the token with a Gordon Growth Model (GGM) or Dividend Discount Model.

Governance tokens are pre-revenue tokens and could be deemed capital assets:

Notwithstanding, in their current state, most governance tokens yield voting rights on the platform but don't accrue revenue. While the intuition is to conclude that this circumstance prevents a DCF valuation, the reality is that a plethora of high-growth stocks – especially tech stocks – don't pay dividends. For instance, Apple didn't pay a single dividend for seventeen years (1995 to 2012). Simply put, companies are better off reinvesting the profits during high-growth periods instead of paying out dividends. Arguably, the same phenomenon is happening with governance tokens today, as most dApps are in the early stages of their lifecycle, and thus reinvestment in the protocol is very high.

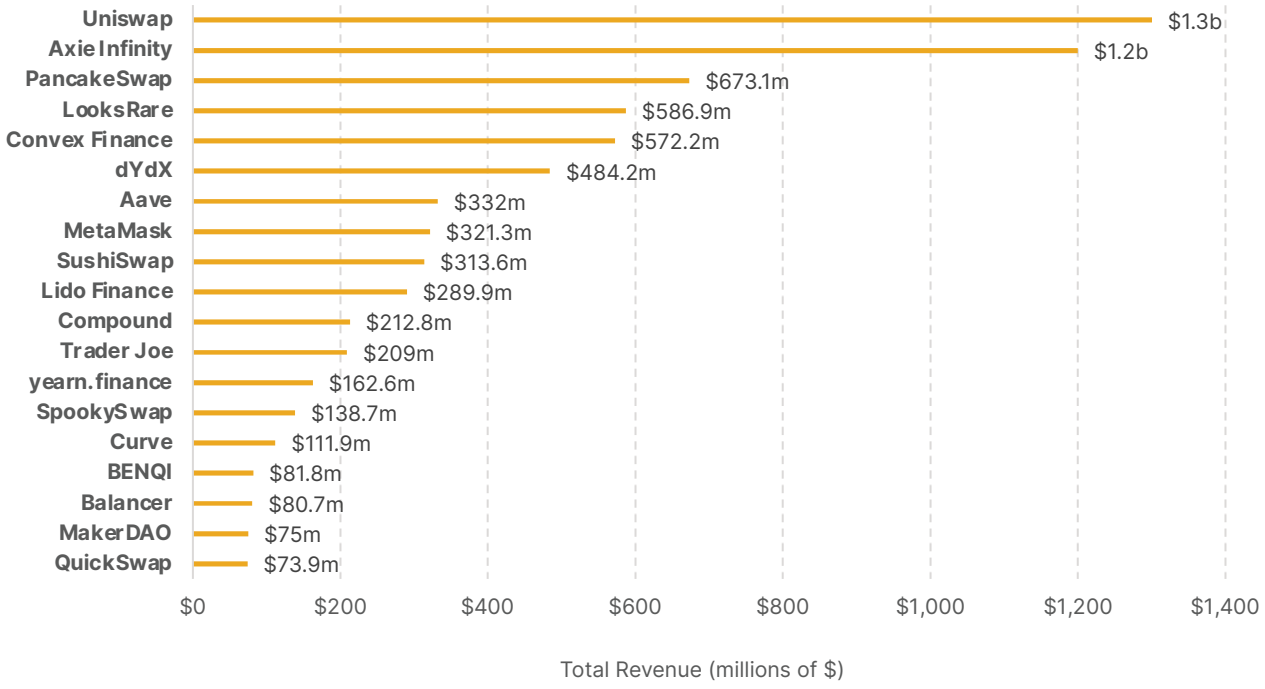
As dApps mature in the next 5-10 years (again, Apple didn't pay a single dividend in seventeen years!), investors should expect them to generate large and positive cash flows. Otherwise, a governance token will find it virtually impossible to accrue value in the long term. For this reason, we argue that governance tokens are capital assets, meaning they can be valued using a DCF valuation.

Uniswap, a decentralized exchange:

Figure 7 shows the top dApps based on their cumulative revenue in the past year as measured by total fees paid by users. Applications like Uniswap and Axie Infinity generated more than $1 billion in revenue. Uniswap's token, UNI, does not currently accrue part of the protocol's profits; only liquidity providers (LPs) do. However, because governance token holders are collectively the owners of the future of Uniswap, a proposal and corresponding approved vote can change the platform's parameters. UNI holders could, for example, vote to pay themselves a dividend funded by a portion of the protocol's revenues. In the long term, most dApps will likely take a similar route.

Figure 7:
Top dApps based on cumulative revenue in the past 365 days.

Source:
Token Terminal, date 27-Jul-2022



PoW Cryptoassets

Bitcoin: As mentioned in the previous sections, PoW cryptoassets rely on a computationally and energy-intensive lottery called mining to verify, settle transactions and secure the network. The native asset of a PoW network like Bitcoin is not one of the inputs of production but the mere output of it. Hence, we refer to PoW cryptoassets as *"crypto-commodities."*

The Marginal Cost of Production: When it comes to commodities, Professor Damodaran would argue that they cannot be valued, only priced against their own history. In practice, however, the marginal cost of production is vital for commodities, as it sets the price floor at which producers (miners) are willing to sell. From the outset, it is crucial to emphasize that we are not suggesting that the price of BTC should be determined by its marginal cost of production. To do so would be to adopt a labor theory of value, which is ostensibly false. Instead, the marginal cost of production is a tool that can help investors estimate a lower bound price level for BTC and other crypto-commodities.

In February 2010, Satoshi Nakamoto, Bitcoin's anonymous creator, wrote the following statement on Bitcointalk:

"The price of any commodity tends to gravitate toward the production cost. If the price is below cost, then production slows down. If the price is above cost, profit can be made by generating and selling more. At the same time, the increased production would increase the difficulty, pushing the cost of generating towards the price.

In later years, when new coin generation is a small percentage of the existing supply, market price will dictate the cost of production more than the other way around."[15]

From an investor's perspective, what's crucial to realize is that miners are compulsory sellers in PoW networks because of the high capital expenditure on mining hardware, facilities, and power consumption. Mining is also very competitive and operates on slim profit margins because of the "difficulty adjustment" that Nakamoto alluded to. In other words, when more miners join the network and the hash rate increases, the difficulty of solving a block will also increase so that the average amount of time it takes to confirm a block stays the same. For example, with Bitcoin, it takes an average of 10 minutes to find a valid nonce and create a new block.

With this in mind, let us explain a methodology to estimate Bitcoin's Cost of Production.

Mining Production Cost

In 2019, Charles Edwards proposed a methodology to estimate the global average US dollar cost of producing one BTC. The first component of the method is the **Cambridge Bitcoin Electricity Consumption Index (CBECI)**, which provides an up-to-date estimate of the Bitcoin network's daily electricity load. The underlying model is based on a bottom-up approach initially developed by Marc Bevand that uses the profitability threshold of different types of mining equipment as the starting point. Edwards estimates the cost of production per BTC by:

1. Calculating the number of BTC Mined Per Day (based on miner rewards)
2. Calculating the daily electricity cost to mine one BTC (Daily Electrical Cost)
3. Estimating the global average "Elec-to-Total Cost Ratio" = (Bitcoin Electrical Cost) / (Daily Cost of running a Bitcoin Mining Business)

An investor can then compute Bitcoin Production Cost as (Daily Electrical Cost) / (Elec-to-Total Cost Ratio). Finally, the Bitcoin Production Cost is compared to the "Bitcoin Miner Price," which attempts to capture the revenue one BTC provides to miners. Bitcoin Miner Price is calculated as follows: BTC Price + (Daily Transaction Fees) / (Daily BTC mined).

[15] https://bitcointalk.org/index.php?topic=57.msg415#msg415

Figure 8:
Bitcoin Cost of Production
(October 2017 – July 2022)

Source:
TradingView, script by
Charles Edwards

Figure 8 above shows BTC's cost of production since late 2017. As we can observe, past cycles' bottoms have roughly coincided with BTC's cost of production range estimate. When BTC Miner Price is below the total cost of mining one BTC, it signals that Bitcoin miners are struggling and potentially taking short-term losses.

As of July 28, 2022, the estimated global average electricity cost to mine one BTC is $12,178, while the estimated global average total cost to mine one BTC is $20,298.12. As mentioned, investors shouldn't interpret this range as the fundamental value of Bitcoin, which is subjective, but rather as an estimate of its price floor based on miner profitability and subsequent behavior patterns.

Valuation Frameworks

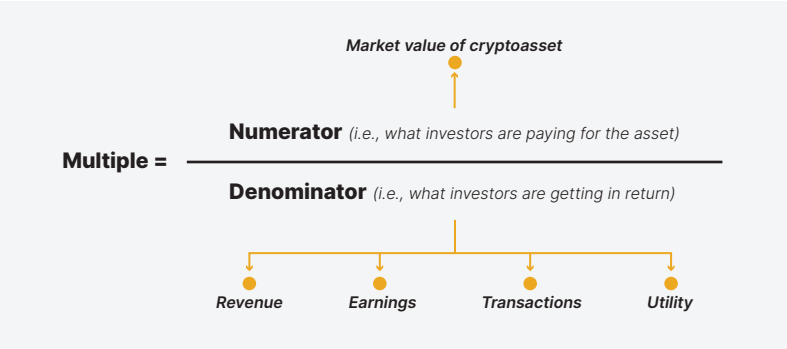
Relative Valuation (Pricing)

Multiples

A significant portion of equity valuations in traditional finance consists of relative valuations based upon multiples and comparables. As mentioned in previous sections, this approach helps determine whether a given asset is undervalued or overvalued relative to its peers. Damodaran defines a multiple as a "standardized estimate of price." As figure 9 shows, the "numerator" is what investors are paying for the cryptoasset as measured by its market capitalization. On the other hand, the "denominator" is how investors standardize the price of comparable assets.

Figure 9: Relative valuation based upon "multiples"

Source: 21Shares



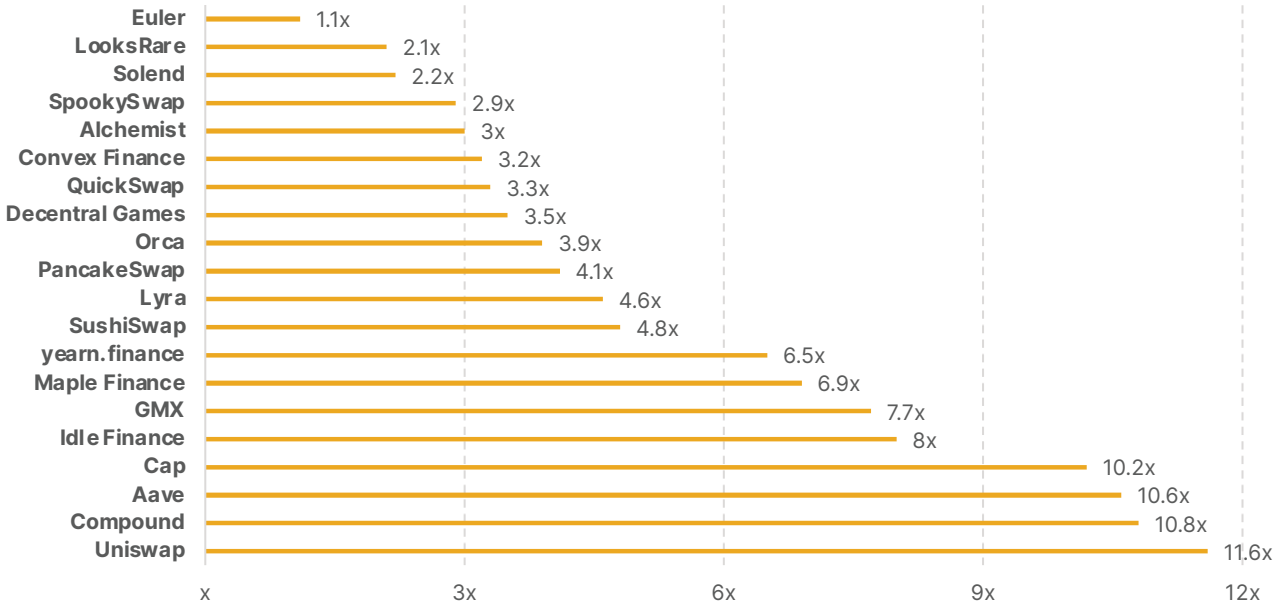
In the following sections, we will explore various "multiples", including the Price-to-Sales Ratio, Network-Value-to-Transaction (NVT) Ratio, Price-to-Utility Ratio, and Market Cap to Thermocap Ratio.

P/E and P/S Ratio

Just as investors price equities with Price-to-Earnings (P/E) or Price-to-Sales (P/S) ratios, it is possible to apply the same logic in the context of crypto-capital (i.e, PoS cryptoassets and governance tokens). For instance, Figure 10 shows the top dApps with the lowest P/S ratios. This particular P/S ratio is calculated based on annualized revenue, such that an investor computes the metric as follows: market capitalization of a token / annualized total revenue of the protocol.

Figure 10:
Top dApps based on lowest P/S ratio (annualized total revenue)

Source:
Token Terminal, date 26-Jul-2022



In this regard, investors could set price estimates based on P/E or P/S multiples. Table 5 below shows the implied value per ETH based on the average PE multiples of companies in the S&P 500, fast-growing companies, and extremely fast-growing companies. For reference, the current P/E ratio of Tesla, a fast-growing company, is 99x (July 28, 2022). Investors could argue that ETH merits a higher multiple because it is earlier in its life cycle. For instance, Ethereum's revenue in 2021 increased ~1,500% year-over-year.

Table 5:
Ethereum pricing based on P/E multiples

Original Source:
Ryan Allis, Coinstack

Current Market Cap
$206,175,837,800.80

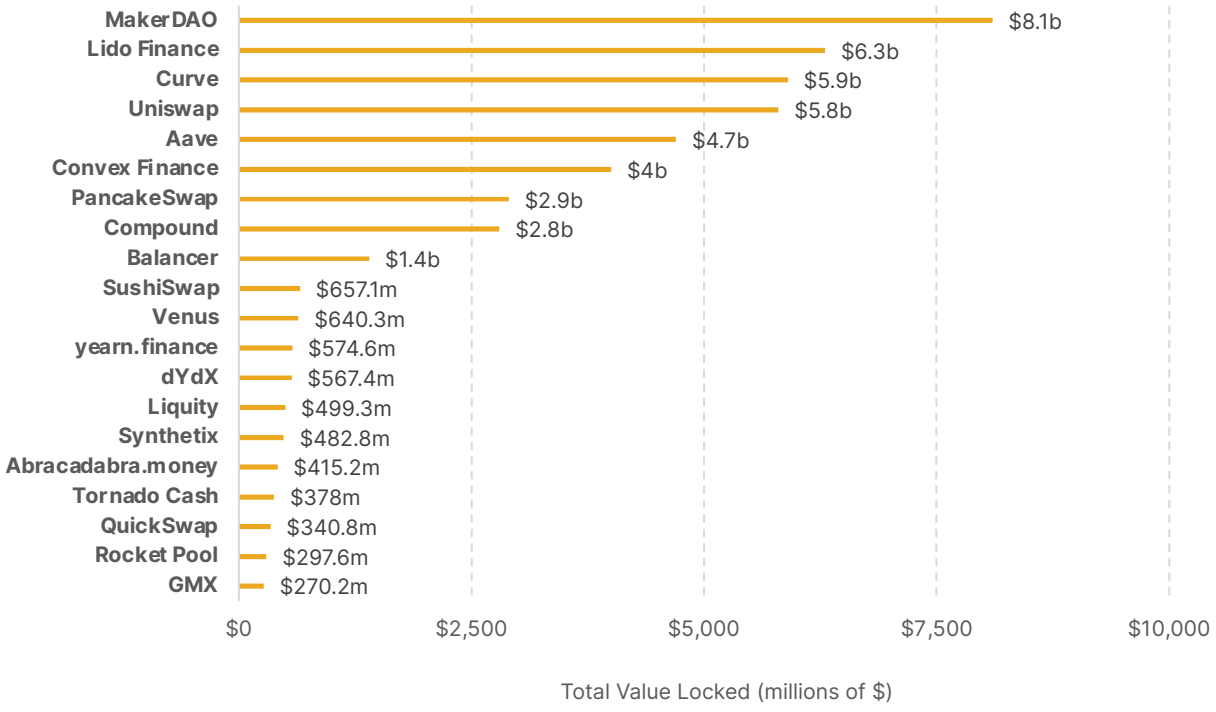
PE Ratio Comparative Valuations	P/E Multiple	Implied Valuation	Implied Value Per ETH	Expected Increase
Actual Ethereum PE Ratio	24.35	$206,175,837,800.80	$1,720.00	0%
Average Company in S&P 500	35	$331,586,094,315.00	$2,883.36	61%
Fast Growing Company	100	$947,388,840,900.00	$8,238.16	360%
Extremely Fast Growing Company	200	$1,894,777,681,800.00	$16,476.33	819%

Total Value Locked (TVL)

In decentralized finance (DeFi), total value locked (TVL) is a crypto-native metric that investors can use as a proxy for assets under management. Hence, an ingenious pricing approach is to represent the market value of the governance token as a multiple of TVL. When comparing two assets, the one with the lower Market Cap/TVL ratio would be undervalued relative to its peer. Figure 11 shows the top dApps based on TVL.

Figure 11:
DeFi dApps based on Total Value Locked (TVL)

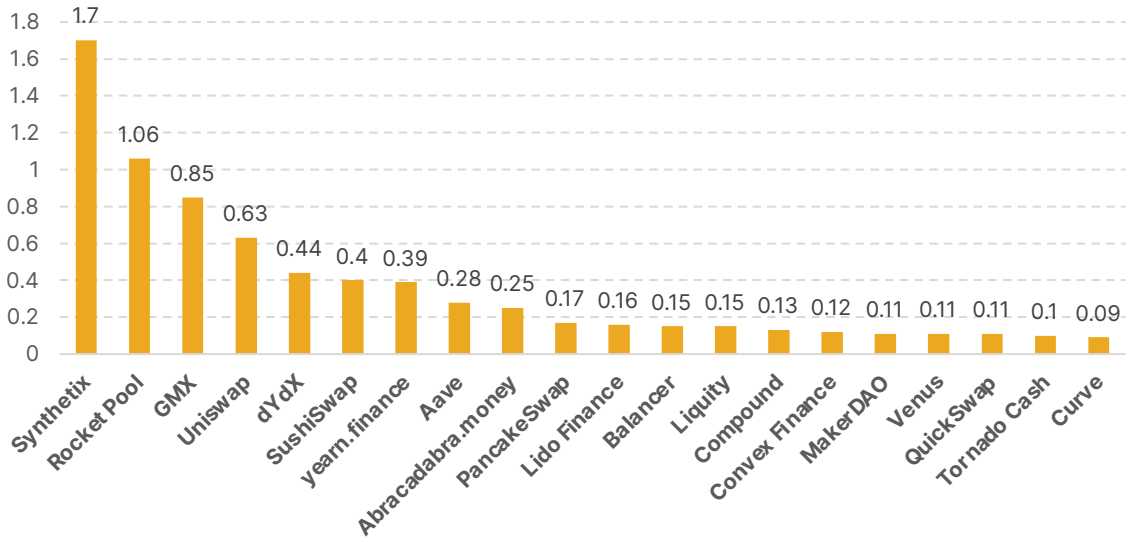
Source:
Token Terminal, date 27-Jul-2022



Notice that only comparing the absolute TVL metric across various dApps is inaccurate, as we disregard the market value of the cryptoassets. In this regard, Figure 12 shows the top dApps based on their Market Cap/TVL ratio. The interpretation would be that cryptoassets on the right side of the chart are undervalued relative to the ones on the left. However, some investors might object to this conclusion because a high TVL does not necessarily translate to higher profits. Thus, this multiple is only appropriate to the extent that TVL can effectively influence the protocol's ongoing and future profits. For instance, some protocols might have a high TVL but no means of monetizing it. This scenario is somewhat analogous to tech stocks with substantial user traction that struggle to monetize their service (e.g., Twitter), negatively impacting the stock's performance.

Figure 12:
DeFi tokens based on Market Cap/TVL

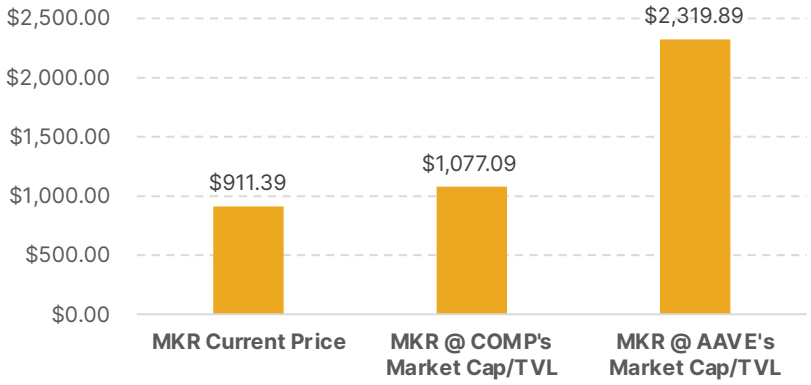
Source:
Token Terminal, CoinGecko, date 27-Jul-2022



Bearing in mind this caveat, we can use this multiple to price cryptoassets by looking at what other investors are paying for comparable assets. For example, MakerDAO is the largest lending protocol by TVL at $8.1 billion as of July 27, 2022. Therefore, we can compare its Market Cap/TVL ratio to other blue-chip lending protocols like Compound and Aave to determine its "fair" price if MakerDAO's native token – MKR – achieves these multiples.

Figure 13:
MKR price estimates based on Market Cap/TVL ratio of main competitors.

Source:
21Shares, date 27-Jul-2022



Caveats of TVL: There is a risk of double-counting and inflating Total Value Locked. For instance, let us suppose a user deposits 5 ETH in "X" dApp like Uniswap, gets back five (5) new tokens, called xETH, and goes on to deposit these new tokens on "Y" dApp, such as Sushiswap. Even though the user only had 5 ETH initially, if both "X" and "Y" dApps count deposits for their respective TVL, there will be a double-counting error. In other words, five (5) more ETH would be accounted for out of thin air. Worse still, it has been discovered that some protocols have historically inflated their TVL metrics purposefully in this manner. Hence, investors need to take these metrics with a grain of salt and be extra inquisitive regarding the accounting method.

Network-Value-to-Transactions (NVT) Ratio

The Network-Value-to-Transactions (NVT) Ratio measures the dollar value of on-chain transaction activity of a given protocol relative to its Network Value. This method views these protocols as 'network commodities.' Bitcoin analyst Willy Woo introduced NVT as a metric analogous to the P/E ratio used in equity markets but adapted to Bitcoin.

$$\text{NVT} = \frac{\text{Network Value}}{\text{Value of On – Chain Transaction Activity}}$$

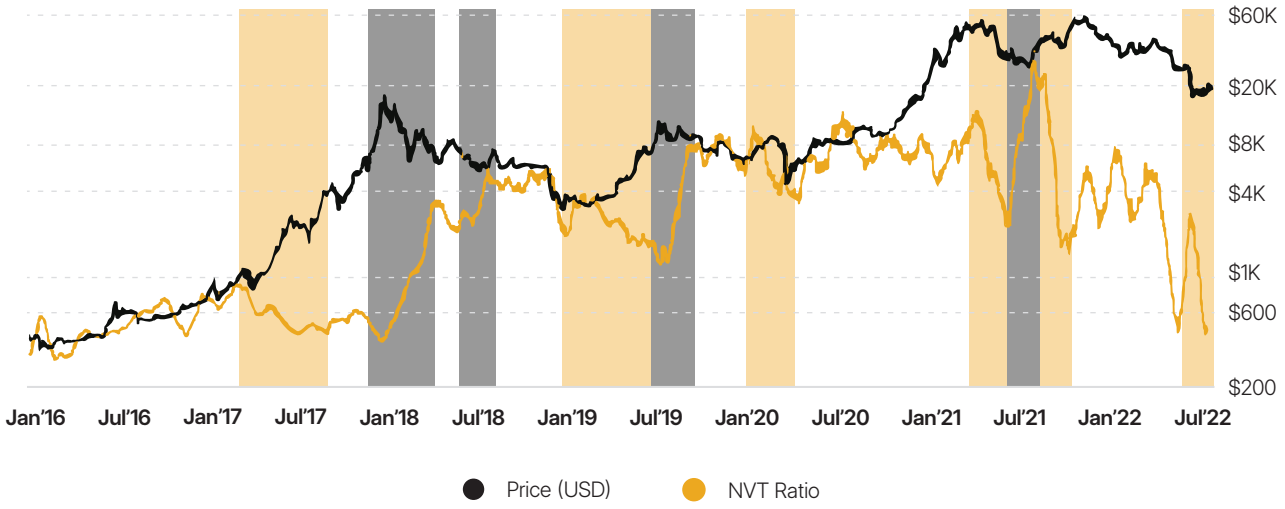
By comparing the current NVT ratio to its mean over some time, we can measure how over or undervalued the asset is at a given point in time and use this to scale the token's market capitalization accordingly to arrive at a "fair" price. For example, suppose the current NVT Ratio is 25% lower than the historical average. In that case, investors could adjust the current market cap upwards proportionally to produce an estimate of its NVT-based implied value.

Figure 14 shows Bitcoin's NVT ratio compared to its price history since 2016. Periods of rising NVT (grey) suggest declining fundamentals and a bearish outlook, while periods of declining NVT (yellow) suggest improving fundamentals and a bullish outlook. We should note that this indicator is not always accurate. Also, it works best for momentum-based strategies and for shorter timeframes. However, it can still be a valuable tool for investors to gauge if the asset is overvalued or undervalued.

Additionally, using daily data from July 2010 to July 2022 (sample size = 4,393), Bitcoin's NVT historical average is 64.12. As of July 26, 2022, Bitcoin's NVT ratio is 45.34, which means that BTC is trading 29.28% below its historical NVT average. However, some investors might prefer using the median NVT as a more accurate measure because the median is not affected by outliers or the skewness of the data. For instance, during Bitcoin's first years of existence, the NVT ratio experienced wild swings, from as high as 450 in August 2010 to as low as 3.72 in November 2011. In this regard, BTC's NVT historical median is 55.87, which means that BTC is currently trading at an 18.85% discount by this metric.

Figure 14:
Bitcoin's NVT Ratio (30-day MA) compared to its price history (2016-2022)

Source: Glassnode



To estimate the NVT-based implied value, we must first calculate the 30-day average daily value of on-chain transaction activity in the Bitcoin network. With a 30-day average transaction value of $10 billion, we can now apply our average and median "multiples" (64.12 and 55.87, respectively) to arrive at a Bitcoin implied market value range between $560 and $643 billion, which translates to a price range between $29,346 and $33,679 per one BTC, as shown in Table 6.

Table 6:
Bitcoin's NVT-based implied price

Data source:
Messari, as of July 26, 2022

▲ DATE ▼	17/07/10 26/07/22	
	Sample Size (Days)	4393
a	Average NVT Ratio	**64.12**
b	Median NVT Ratio	**55.87**
c	30-day average daily on-chain tx value	$10.04 billion
d	BTC Circulating Supply	$19.10 million

Implied BTC Market Cap	
a x c =	$643.47 billion
b x c =	$560.70 billion

Implied BTC Price	
(a x c) / d =	$33,680.05
(b x c) / d =	$29,347.55

Price-to-Utility (P/U) Ratio

Shortcomings of NVT failing to capture the store of value component of cryptoassets: Investors can use the NTV ratio to produce a relative valuation by standardizing price with the flow of transactional value through the network. However, this method does face certain limitations. NVT focuses on the token serving as a medium of exchange (MoE), but it falls short in accounting for the SoV component that some cryptoassets tend to reflect.

To illustrate, in the context of smart contract platforms such as Ethereum or Solana, their native tokens are all used as the transacting currency for on-chain dApp interactions, like purchasing an NFT collection or paying for transaction fees. However, almost by definition, validators also believe that value will accrue to the token as their hosted app-layer ecosystem continues to grow and the native asset's demand increases in line with its escalating utility.

The various monetary policies in crypto impact value: In addition, specific platforms like Ethereum or Avalanche also feature token burn programs where tokens like Ether or Avax are removed out of circulation permanently. This practice offers compelling prospects as it effectively restricts supply – analogous to the halving's impact on Bitcoin – causing a price appreciation to occur if the demand increases or stays the same while nullifying the networks' inflation rate. In other words, this monetary policy transforms some networks into deflationary assets.

What is worth emphasizing here is that the same mental model that demonstrates the triple characterization of PoS tokens (CA + C/T + SoV) on the base layer is also pertinent to the interoperability and scalability layers. Examples in the interoperability vertical include networks like Polkadot and Cosmos, while Polygon and Optimism could be examples of the scalability vertical. The use case of the PoS network is almost irrelevant – from an investor's perspective, the native token fulfills a homogenous role across all PoS networks; the only nuances are the specific means of extracting revenue between different blockchains. With this mental framework in place, we'll proceed to choose Polkadot as a case study for this metric.

Application

Polkadot: Polkadot is a protocol on which independent blockchains – dubbed "parachains" – are built and connected into one unified network — "the Relay Chain". It employs a shared security model whereby the native asset "DOT" secures all parachains. This design means that an increasing number of projects joining Polkadot's main blockchain would increase the demand for the shared security overseen by the validators, which in turn boosts the future cash flows that stakers receive.

Price-to-Utility Ratio: With this in mind, investors can think of DOT as a hybrid between a MoE and SoV. This designation makes it appropriate to discuss the Price-to-Utility metric introduced by Yu Liu, which accounts for both asset properties. On the one hand, it serves as a capital asset since the

token can be staked and generate cash flows for its holders or yield further dividends with on-chain activities like "bonding" and "crowd-loading." On the other hand, users also need DOT to transact with the ecosystem or participate in cross-chain messaging, which deems it a consumable asset.

As we'll illustrate, the P/U metric considers elements like token velocity and staking ratio, which reflect the MoE and SoV components, respectively. At the risk of being redundant, this delineation isn't just limited to DOT because, as already pointed out, PoS tokens under all three layers (L0, L1, L2) share the same core functions related to staking.

$$\textbf{Price to Utility Ratio (PU)} = \frac{\textbf{(Market Cap)}}{\textbf{(Token Utility)}}$$

To produce the PU ratio, we need to work out two variables, (1) the utility of the chosen token and (2) its network capitalization. Liu defines the utility of a token as $\frac{\textit{Token Velocity X Staking Ratio}}{\textit{Dilution Rate}}$.[16]

In this regard, token velocity is calculated with the following formula: $\frac{\textit{Total Transaction Value}}{\textit{Average Network Value}}$.

Investors can interpret velocity as the number of times a token changes hands relative to the total supply, making it the best proxy for a currency's role in serving as a medium of exchange.

In addition, investors can estimate the staking ratio with the formula: ($\frac{\text{Number of Staked Tokens}}{\text{Total Token Supply}}$). A high staking ratio would signify that users have high expectations regarding the network's long-term growth prospects. In this scenario, users perceive the project to be more valuable, which can increase the token's value if translated to the supply and demand dynamics. Over the long term, this could allow the cryptoasset to consolidate as an SoV asset. In sum, a high staking ratio effectively manifests the utility of a token serving as SoV because validators must commit the internal asset of the system. Therefore, it is only rational to "stake" if they believe in the asset's long-term value.[17]

Finally, we should note that this approach only makes sense to the extent that low and predictable annual rates of supply inflation are programmed into the blockchain. Highly inflationary PoS cryptoassets would dilute the value of non-stakers disproportionately, disincentivizing its use case as an SoV asset.

[16] Potentially, this metric could be applied to PoW cryptoassets as well. In this case, instead of using the "staking ratio", investors would use the percentage of supply held by long-term holders, or a similar proxy.

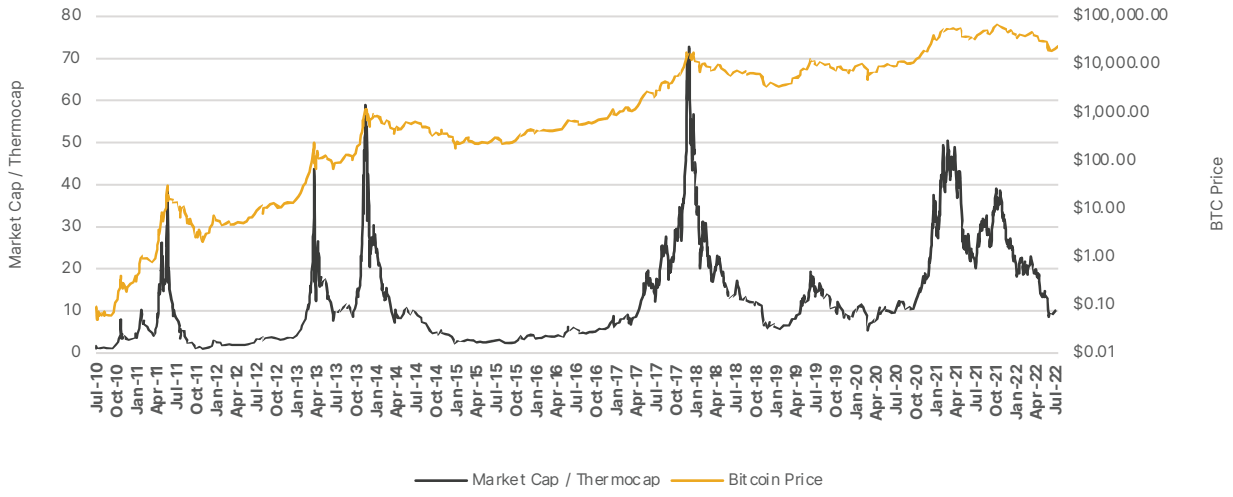
[17] We were not able to apply the Price-to-Utility ratio to Polkadot due to lack of historical data regarding the staking ratio and supply locked in "crowd-loans".

Market Cap to Thermocap Ratio

"Thermocap" is the cumulative sum of USD block rewards paid to miners. Nic Carter introduced this metric as a proxy of the aggregate cost of production for all circulating BTC. Thus, investors can use the market cap to Thermocap ratio to assess if the asset's price is currently trading at a premium to the total security spent by miners. Figure 15 shows the market cap to Thermocap ratio since 2010.

Figure 15:
Market Cap to Thermocap Ratio (July 18, 2010 - Jul 31, 2022)

Source:
21Shares, Thermocap data by Glassnode, Market Cap data by Messari



As we can observe, a high market cap compared to total aggregate security spent has historically been an indicator that BTC is relatively overvalued and near the top of a market cycle. Conversely, a low market cap to Thermocap ratio has historically signaled that BTC is relatively undervalued and near the bottom of a cycle. As of July 21, 2022, BTC's market cap to Thermocap ratio is 10.70. The interpretation of this ratio is that, at a market cap of $452 billion, BTC is worth 10.70 times more than its total input costs. In addition, by comparing the current ratio to its historical mean, we can measure how over or undervalued BTC is at a given point in time and use this to scale the token's market capitalization accordingly to arrive at an implied "fair" price.

Using daily data from July 2010 to July 2022 (sample size = 4,397), BTC's market cap to Thermocap's historical average is 12.21. However, some investors might prefer using the median as a more accurate measure because it is not affected by outliers or the skewness of the data. In this regard, BTC's market cap to Thermocap's historical median is 9.25. Table 7 shows BTC's implied range price based on these multiples.

Table 7:
BTC's implied range price based on Market Cap to Thermocap multiple

▲ DATE ▼	18/07/10 31/07/22	
	Sample Size (Days)	4397
a	Average Market Cap to Thermocap Ratio	**12.21**
b	Median Market Cap to Thermocap Ratio	**9.25**
c	Thermocap as of July 31, 2022	$42.2 billion
d	BTC Circulaitng Supply	$19.10 million

BTC Implied Market Cap	
a x c =	515,742,323,657.62
b x c =	390,392,975,117.11

BTC Implied Price	
(a x c) / d =	$26,991.04
(b x c) / d =	$20,430.96

Market Sizing

Overview

Most cryptoassets at the infrastructure layer are shaping up to be capital assets in nature (PoS). However, a select number of blockchains still implement a PoW consensus mechanism, as is most clearly the case with Bitcoin. While we refer to this group as "crypto-commodities," we expect that the majority of value accrual for these assets will derive from their use case as an SoV asset, to the extent that PoW cryptoassets like Bitcoin have low, programmable and predictable annual rates of supply inflation. Only digital assets can achieve this quality.

In this sense, investors cannot value SoV assets intrinsically because their value is primarily determined by the subjective beliefs of many individuals. Thus, we can utilize a simple market sizing approach to estimate a target price. The methodology involves establishing a Total Addressable Market (TAM) and a percent share the asset in question could take — Market Penetration. For instance, an investor could price Bitcoin by setting a proportion it could capture of the market value of gold, the seminal SoV asset.

The relative market value is arrived at using this simple formula:

Market Value = Level of Penetration * TAM

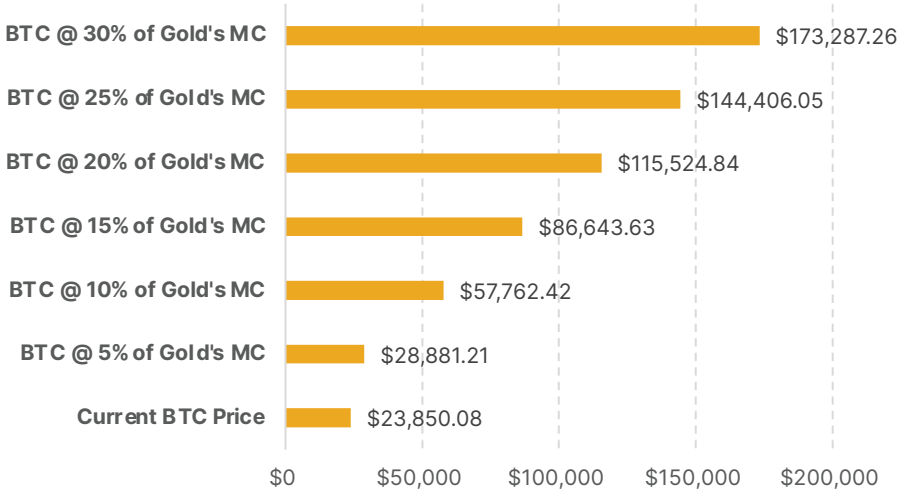
Application

Bitcoin: As of July 28, the price of BTC is $23,850, with an implied circulating market cap of $455.66 billion. On the other hand, the market cap of gold sits at around $11.68 trillion. Thus, we can use the market sizing methodology described above to estimate the hypothetical price of BTC if it were to capture a given percent share of gold's market cap. For instance, Figure 16 shows that if BTC were to capture 10%, it would be priced at **$86,643.** In the most optimistic scenario contemplated, if BTC penetrates 30% of gold's market cap, the price of one BTC would be **$173,287**.

Figure 16:
Hypothetical value of BTC as % of gold's market cap in 2027*

Source:
21Shares, data as of July 28, 2022

*Assuming gold's market cap of $11.684 trillion, and BTC circulating supply of 20.2 million units in 2027.



Optimism and the block space market: Using another example, if we perceive blockchains as sellers of block space, the entire market for block space can be viewed as the TAM. We can then estimate the value of the given chain for three scenarios of penetration into the block space market (users choose to transact on the protocol rather than on the target market).

Let us consider Optimism, a scaling protocol in the Ethereum ecosystem. Optimism uses Ethereum for consensus and re-sells Ethereum blockspace to users for lower fees per transaction and greater throughput. As such, users who may have sent their transactions directly to Ethereum can choose to send them to Optimism instead. Therefore, investors can estimate Optimism's value by establishing a penetration rate of Ethereum's market for block space.

To produce a fair value for Optimism using market sizing in the future, we could:

1. *Estimate the future size of Ethereum's market for block space (ignoring its value derived from network effects).*
2. *Consider three market penetration scenarios for Optimism: low, medium, and high.*
3. *Price Optimism as a proportion of Ethereum's block space market size based on each scenario.*

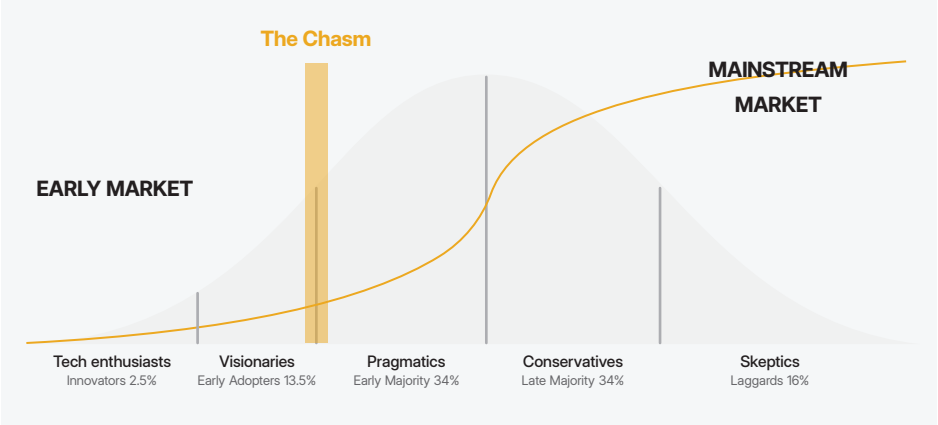
Methodology Improvements

Shortcomings of market sizing: Investors should interpret the results of a market sizing analysis with caution due to the limitations inherent in the valuation model. For instance, the market capitalization of gold is a moving target, and we could be overestimating the percent share BTC could capture in different scenarios. Furthermore, this approach omits other relevant variables, such as the impact of fiat supply inflation. As a store of value asset, BTC should appreciate it as the Fed and other central banks keep increasing the money supply, and fiat loses purchasing power. This section will explore different ways investors can improve the accuracy of market sizing valuations.

The S-Curve: One way to more accurately gauge a given cryptoasset's level of penetration of its TAM is through the "S-curve." The S-curve is a theory that states that technologies grow and emerge in multiple waves. It was initially proposed by E.M Rogers in 1962 as the Diffusion of Innovation (DOI) Theory to explain how, over time, a new technology gains momentum and spreads through a specific population or social system. The end result of this diffusion is that people, as part of a broader social system, adopt a new technological innovation. However, adoption doesn't coincide in every segment of society. Instead, it is a process whereby some people are more prone to adopt the innovation than others. Figure 17 shows the five established "adopter categories" and the portion they represent of the entire social system.

Figure 17:
S-curve and the Diffusion of Innovation Theory

Source:
21Shares design based on http://blog.leanmonitor.com/early-adopters-allies-launching-product/

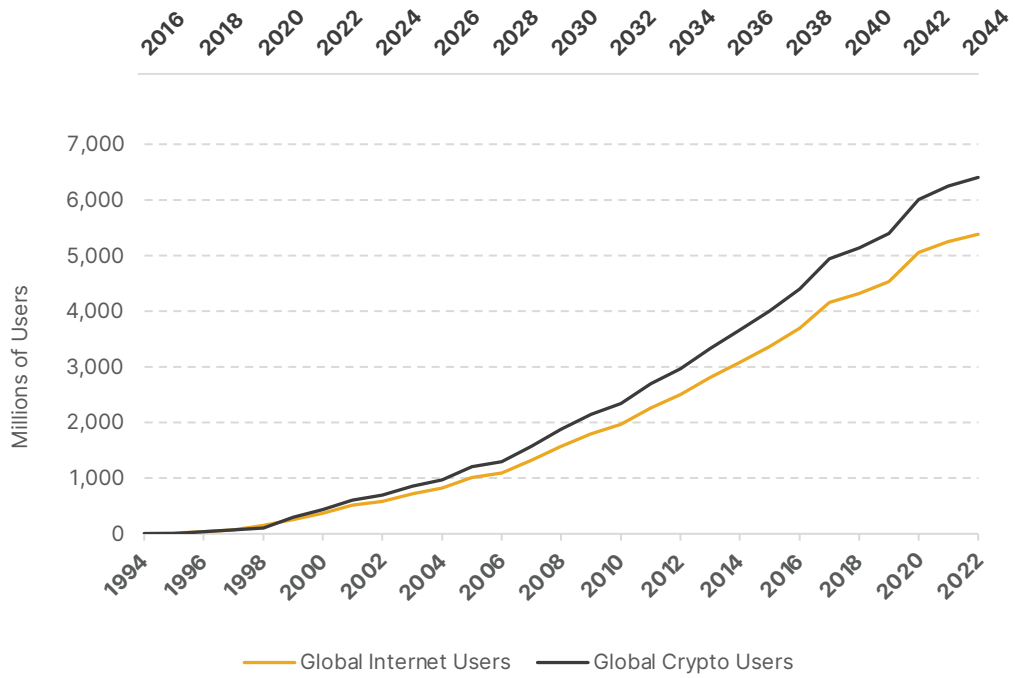


The pace of adoption of crypto, or what we call the S-curve, is interesting for the purposes of our analysis. The S-curve shows the innovation from its slow beginnings as the technology is developed to an acceleration phase (early majority) as it matures and, finally, to its stabilization over time (a flattening curve with late majority and laggards). Most major technological innovations go through an S-curve-shaped adoption – past examples include color TV, the microwave, PCs, mobile phones, and the internet. Now, crypto is going through one of its own.

For example, we can gauge crypto's stage in the S-curve by comparing the number of crypto users to the global internet population. According to data released by Crypto.com, there were 295 million crypto users globally at the beginning of 2022, representing about 3.77% of the world population. The level of crypto adoption today is equivalent to internet adoption in 1998-99, as shown in Figure 18. To project the growth of crypto adoption over the next 20 years, we estimated the Compound Annual Growth Rate (CAGR) of internet users from 1994 to 2022 and assumed crypto would grow at the same rate until 2044 (Expected CAGR of ~28%). For reference, crypto has grown at a CAGR of ~97%, from 5 million users in 2016 to 295 million at the end of 2021. Given this data, one could argue that crypto has yet to cross "the chasm" to the early majority of adopters (see Figure 17).

Figure 18:
S-curve, crypto adoption compared to internet adoption

Source:
21Shares, Data source in Footnote[18]



Another shortcoming of traditional market sizing approaches is that the TAM of certain cryptoassets is not necessarily constrained to a specific field. For instance, BTC could capture a percentage of gold's market as a store of value asset. Still, it could also grab a portion of the US dollar market as a medium of exchange with the Lightning Network or even a percentage of the smart contract platform ecosystem with Stacks. Thus, investors can improve a market sizing methodology in terms of accuracy by dividing the TAM into several use cases. In crypto, on-chain transparency can help us gauge what percentage of an asset's supply is used for specific applications. In the case of Bitcoin, Glassnode data shows that 65.7% of BTC's supply has not moved in at least one year.[19] Hence, an investor could extrapolate that ~66% of BTC's value capture will come from its use case as a store of value asset.

[18] Internet data: https://www.internetworldstats.com/emarketing.htm Crypto data: Statista and Crypto.com

[19] https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.ActiveMore1YPercent&s=1572448116&u=1659398400&zoom=

Using Ethereum as an additional example, we could divide the TAM of Ethereum into the following segments:

- Stablecoins – target market: global payments
- ETH – target market: reserve currency or M2
- Decentralized Applications (dApps) – target market: App Store + Google Play

To summarize, investors can improve a straightforward market sizing approach by estimating the following variables:

1. **S-curve**: Where does the technology (and cryptoasset) stand in terms of adoption versus the target market?
2. **CAGR**: What is the target market's historical compounded annual growth rate? What's the cryptoasset CAGR?
3. **Total Addressable Market (TAM)**: The benchmark — to what market(s) should we compare the cryptoasset? And why?

NFTs

Non-fungible tokens essentially represent a digital proof of ownership. They can take various forms, including event tickets, collectibles, virtual land, redeemables, art, music, deeds, and more. We believe that NFTs will become an essential yet almost invisible part of the infrastructure in the new generation of the internet. For these reasons, it would be impossible and erroneous to value this market in its entirety. Instead, this section attempts to provide a valuation framework for a specific sub-sector – NFTs as art and collectibles.

So-called "blue-chip" NFT projects are collections that are well-known, reputable, and regarded as long-term investments due to their history of value and growth. One of the best examples would be the infamous Bored Ape Yacht Club (BAYC), an NFT collection by Yuga Labs LLC that was released in April 2021 and has seen a meteoric rise in popularity. A simple collection of 10,000 different-looking Apes turned into a multi-billion Web3 project.

Native tokens like Ether are the unit of account for NFTs: A crucial observation of NFTs is that they are not priced in fiat currency but rather in the native token of the ecosystem to which they belong. For instance, NFTs in the Ethereum ecosystem are priced in Ether (ETH). This creates an interesting dynamic because their price in fiat terms becomes directly dependent on the price of ETH, SOL, or the native token of the ecosystem to which they belong. Almost by definition, then, most NFTs will have a high beta to the extent that their returns are correlated to the rest of the crypto market. For instance, suppose the floor price of an NFT collection rises 10%, from 10 to 11 ETH. If the price of ETH rises 20%, from $1,000 to $1,200 over the same period, then in USD terms the floor price of the NFT collection rises 32%. Conversely, if the floor price of the same NFT collection decreases 10%, from 10 ETH to 9 ETH, and the price of ETH decreases 20%, from $1,000 to $800, then in USD terms the floor price of the NFT collection decreases 28%.

In addition to this dynamic, the big question remains: how to value such a project or even a single NFT? First, it's essential to dissect the potential valuation in multiple parts. The first step is to evaluate the art itself. At this point, we can draw inspiration from the traditional fine art market to gain insights into the variables that make up the market value of an art piece. This method combines objective and subjective assessments of an artwork's cultural worth.

In the traditional world, art assessment firms are primarily responsible for performing the valuation of pieces of art. For instance, Sotheby's and Christie's offer services such as art appraisals, determining value by comparing information from several sources, including art auction houses, individual and corporate collectors, curators, art dealer operations, gallerists, advisors, and professional market analysts. In the digital realm, it's mainly the community that sets the value of a given NFT. However, at a high level, we can delineate some variables that investors take into account when assessing an art piece:

Quality - "That certain something." The elusive qualities that prompt individuals to stand in front of a painting with their heads down or users in front of their screens for extended periods. Quality can also be determined by a work's formal characteristics, such as the artist's technical execution and composition, or by the subject matter's poignancy, originality, or relevance.

Condition - Potentially, this factor is more applicable to physical art. A work of art loses value if it is harmed, faded, or pierced. Conversely, an art piece or collectible item is worth more if it's in perfect condition.

Rarity - One of the most critical variables in the physical and digital realm. Fine art, NFTs, and virtually all collectibles tend to be more valuable if they are exceptionally uncommon. For instance, looking at the famous NFT collection of CryptoPunks, we can see that NFTs with rare attributes trade at a significant premium.

Table 8: CryptoPunk rarity premium

Source: Opensea, as of July 31, 2022

Type	% of CryptoPunks	Highest Last Sale	Date of Sale	Price per ETH	Sale Amount in USD
Male	60.39%	667 ETH	April 27, 2021	$2,669.13	$1,780,309.71
Female	38.40%	888.8 ETH	August 28, 2021	$3,247.33	$2,886,226.90
Zombie	0.88%	2,000 ETH	September 11, 2021	$3,267.53	$6,535,060.00
Ape	0.24%	2,501 ETH	February 9, 2022	$3,246.82	$8,120,296.82
Alien	0.09%	8,000 ETH	February 12, 2022	$2,919.71	$23,357,680.00

- **Provenance and history**- An intriguing component of art valuation is provenance. New things generally have a higher value, but artworks function somewhat differently. Collectors usually deem art pieces more valuable if a famous collector or celebrities have owned them. In this sense, the provenance or ownership history of an art piece or NFT may be significant. The transparent and verifiable nature of the history of an NFT is comparable to provenance. An NFT's worth might also increase if it has been displayed or published somewhere prominent.

- **Demand / Network Effects**- Demand and network effects around a collection or a piece of art are one of the main drivers of price. As collectibles lack an objective measure of value, they tend to be somewhat sentiment-driven, and therefore the success of an NFT is dependent on the network effects that it can produce. A solid Twitter following and an engaged Discord community for the artist or the project are the first signs of a potentially high-value NFT. While this isn't always a guarantee for success, sustainable demand and network effects are essential for a project.

In conclusion, while some of these NFTs come as a 1-of-1 unique piece, for which a valuation approach compared to the traditional fine art market could make sense, most of the NFTs come in collections to build a community and brand around them. This circumstance brings us to the core benefit of certain NFTs - **Utility**. Many NFT collections, like the BAYC, come with a utility, which can have various forms and shapes and go beyond the art's standalone value. Below we identify the most common utility features of NFT collections:

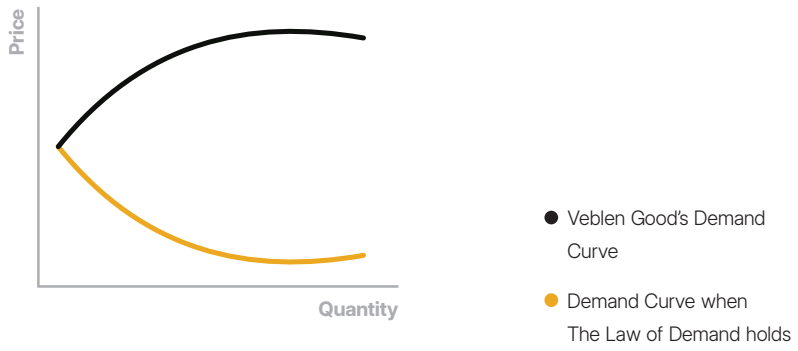
Exclusive access

Often NFT holders are granted exclusive rights and access to future benefits. For example, this could be an additional NFT being "airdropped" to the current holders or exclusive access to certain parties and events. The holder thus feels part of a community, which is hard to put a price tag on.

Status and Prestige

While many of those NFT collections grant access to an exclusive community, network, or club, they are also increasingly becoming a sign of status. We don't need to look far to identify similar characteristics in the real world. A perfect example would be Rolex. Even though a Rolex is a timepiece that embodies sophisticated craftsmanship, most of its value is derived from its inaccessibility, limited supply, and the prestige associated with the brand. Such luxury goods, also known as **Veblen goods**, create an upward-sloping demand curve, meaning demand increases as the price increases. While this behavior appears to defy the law of supply and demand, the higher prices of Veblen goods make them even more desirable from a social status perspective. We can apply the same logic to certain blue-chip NFTs. As digital identity becomes increasingly important to many people, owning such an NFT becomes more of a social statement.

Figure 19: Demand curve of Veblen goods.



Beyond Collectibles

NFTs can encompass a plethora of use cases outside collectibles. For example, artists can use "royalty-generating NFTs" to sell their content directly to their fans. Royalty NFTs generate cash flows and could be labeled capital assets. There are also "redeemable NFTs," representing ownership of real-world items, such as deeds to a car. Redeemable NFTs are consumable/transformable assets. Below we describe some of these use cases:

Commercial rights

In the example of the BAYC collection, NFT holders also have full ownership and commercial rights to their apes, which sets the stage for more commercial ventures and potential revenue streams based on one single NFT. For example, holders can sell merchandise and appliances or even lend intellectual property (IP).

Royalties

Royalties are another benefit of NFTs. As a creator, royalties are usually set during the minting process and promise an endless revenue stream based on a share of the future trading volume. In the case of music NFTs, artists can capture some revenue share in the form of royalties if a given track becomes a hit. In that sense, NFTs can become royalty or dividend-generating assets. Thus, they are capital assets, which theoretically would allow a DCF valuation.

Redeemables

While some NFTs are collectibles, others can represent deeds to a real-world item. For instance, Adidas' Into The Metaverse NFT collection consists of 30,000 identical-looking NFTs, which grant access to future digital experiences. In addition, holders can also redeem physical goods with their NFTs, like an Adidas tracksuit, hoodie, or beanie. In this case, we would consider the NFT a consumable or transformable asset.

Valuation Frameworks

Challenges to Cryptoasset Valuations

There are various challenges and shortcomings when it comes to cryptoasset valuations, as shown below:

Fundamental Valuations

- **Lack of historical data.** While cryptoassets like Bitcoin, and to a certain extent Ethereum, have a decent track record, most are still in their embryonic stage, which translates into having minimal historical data about the network's financial health. As a result, investors have little to work with to shed light on future projections.

- **Discount rate.** While we have used the CAPM, and Fama and French Three-Factor Model to calculate the expected rate of return, traditional investors have pointed out many flaws in this approach. For instance, both approaches assume that the marginal investors are well diversified and that the only risk they perceive in a given investment cannot be diversified away (i.e., market or non-diversifiable risk).

- **Risk-free rate.** At an intuitive level, the risk-free rate should represent the return investors can earn on guaranteed investments. The risk-free rate is currency-specific, which means that investors that conduct their analysis in US dollars will likely use Treasury bills as a proxy. In the long term, however, some cryptoassets such as ETH, or even BTC through the derivatives market, could have their own risk-free rate. It wouldn't make sense today to call the staking yield of ETH a "risk-free" rate as most investors would denominate the analysis in dollars or another fiat currency. Thus, a risk exists that the value of ETH itself falls even though it pays a guaranteed yield.

- **Risk premium.** One of the biggest challenges when valuing PoS cryptoassets is estimating the risk premium. For equities, investors tend to use the historical premium, meaning the excess return that stocks historically have earned over riskless securities. In this regard, some investors use nearly eighty years of data to minimize the standard error of the risk premium. Here again, the necessity of historical data becomes a problem in the context of cryptoassets, as most of them are less than five years old. A possible solution is to devise a more intuitive measure of risk. For instance, we know that the annualized volatility of the largest PoS cryptoassets is well above 80%, whereas the annualized volatility of the S&P 500 sits around 20%. Hence, a creative investor could assume that the risk premium for cryptoassets

will be at least four times higher than the S&P 500. Another more sophisticated solution would be to use bottom-up betas, which don't require historical data but rely on a large sample of cryptoassets to minimize the standard error.

- **Challenges relative to traditional equities.** The cash flows that PoS networks generate are not paid in fiat currency but rather in the native tokens of the network. This situation is as if Apple charged its customers in Apple shares instead of US dollars. This unique feature creates a reflexivity problem because the dollar-denominated value of the dividends is directly dependent on the value of the cryptoasset.

- **PoW Cryptoassets – Cost of Production.** Although the marginal cost of production is vital for commodities, there are some crucial differences between crypto-commodities and their physical counterparts that could theoretically refute this valuation metric. For instance, with physical commodities, if the price is below cost, then production slows down. In contrast, Bitcoin is on a predetermined path to 21 million units, and one block is proposed every 10 minutes on average. Most importantly, the difficulty adjustment could potentially create a death spiral in the cost of production. This being said, the cost of production has empirically proven to be a key level for BTC in multiple market cycles.

Relative Valuations

- **"Multiples" limitations.** Investors have developed multiples in the equities market to gauge the probability of a crisis or financial correction based on decades of historical data. For instance, Nobel Prize recipient Robert Shiller estimated a weighted average of the market's PE ratios from 1871 to the present to come up with the so-called Shiller's CAPE (Cyclically Adjusted Price Earnings), which investors use to gauge if the market is overvalued and due for a correction. As most cryptoassets have less than five years of data, this type of multiple is not yet possible to formulate.

- **Market sizing limitations.** Investors should interpret the results of market sizing valuations with caution. First, the market capitalization of both the cryptoasset in question and the total addressable market (TAM) is a moving target. In addition, the investor could overestimate the percent share the asset will capture. Another factor to consider is that investors usually use this approach in the context of SoV assets. In this regard, market sizing omits relevant variables such as the impact of fiat supply inflation. Store of value assets should appreciate as central banks keep increasing the money supply, and fiat currencies lose purchasing power.

- Finally, it is worth mentioning that a way to enhance the credibility of relative valuation approaches is via "triangulation", which in the context of research means using multiple approaches to address the same question. Performing multiple valuation methods forces investors to undergo a "sanity check".

It is appropriate to conclude this section with a timeless remark from Damodaran, who states that the three "sins" of valuation frameworks are bias, uncertainty, and complexity. In the context of cryptoassets, these factors are exacerbated:

- **Bias.** Investors will always have a preconception of the cryptoasset before valuing it. The valuation can yield disparate results when prejudices are set, especially in DCF methodologies. Because the inputs are difficult to estimate, investors can manipulate them to show the desired outcome and confirm their bias.

- **Uncertainty.** This paper attempts to provide investors with the right tools to value this asset class as there is no objective measure of value for cryptoassets today. However, it is worth remembering that the more uncomfortable an investor feels when valuing an asset, the greater the payoff of doing the valuation. Another factor that adds to the uncertainty is the ultra-high-growth stage in which most networks and protocols are, which makes it difficult to estimate their future growth correctly.

- **Complexity.** The core principle of Damodaran concerning valuations is to be parsimonious: "If you can do something with three inputs, don't be looking for five ." In most cases, simpler valuations do much better than complex ones. Throughout this paper, we have attempted to adhere to this principle.

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Conclusion

We have proposed a general framework to value different types of cryptoassets. Below we summarize the key takeaways:

- When it comes to **valuation frameworks**, we can distinguish between **two approaches – intrinsic** and **relative valuations**. Intrinsic valuation relates the value of an asset to its capacity to generate cash flows. On the other hand, relative valuation (also called "pricing") estimates how much to pay for an asset based upon what others are paying for comparable assets.

- We propose a taxonomy of cryptoassets at the blockchain and application layer. At the blockchain layer, we can distinguish between **Proof-of-Work (PoW)** and **Proof-of-Stake (PoS)** cryptoassets. The core difference from a valuation standpoint is that in PoS networks, the internal asset is one of the block production inputs, making it a Capital Asset. In contrast, we describe PoW assets as "crypto-commodities." Furthermore, we distinguish between **governance, non-fungible, and utility tokens at the application layer**.

- A **discounted cash flow (DCF)** valuation is appropriate for PoS cryptoassets and governance tokens. Governance tokens are analogous to common stock in traditional finance, as they yield voting rights on the platform and have the potential to accrue a percentage of the protocol's future profits. Most cryptoassets in the infrastructure layer (smart contract, interoperability, and scaling protocols) are shaping to be capital assets, as is the case with most cryptoassets in the application layer.

- Investors can use the **mining cost of production** as a fundamental metric to gauge the lower bound value of PoW cryptoassets like Bitcoin.

- Investors can apply relative valuation approaches to any cryptoasset via **"multiples"** and **market sizing**. Multiples provide a standardized price estimate and help determine whether a given asset is undervalued or overvalued relative to its peers. On the other hand, market sizing tends to be more appropriate for "store of value" assets. This approach involves establishing a total addressable market (TAM) and a percent share the cryptoasset could capture.

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This report has been prepared and issued by 21Shares AG for publication globally. All information used in the publication of this report has been compiled from publicly available sources that are believed to be reliable, however we do not guarantee the accuracy or completeness of this report. Cryptoasset trading involves a high degree of risk. The cryptoasset market is new to many and unproven and may have the potential to not grow. Currently, there is relatively small use of cryptoassets in the retail and commercial marketplace in comparison to relatively large use by speculators, thus contributing to price volatility that could adversely affect an investment in cryptoassets. In order to participate in the trading of cryptoassets, you should be capable of evaluating the merits and risks of the investment and be able to bear the economic risk of losing your entire investment. Nothing in this email does or should be considered as an offer by 21Shares AG and/or its affiliates to sell or solicitation by 21Shares AG or its parent of any offer to buy bitcoin or other cryptoassets or derivatives. This report is provided for information and research purposes only and should not be construed or presented as an offer or solicitation for any investment. This information provided does not constitute a prospectus or any offering and does not contain or constitute an offer to sell or solicit an offer to invest in any jurisdiction. Readers are cautioned that any such forward-looking statements are not guarantees of future performance and involve risks and uncertainties, and that actual results may differ materially from those in the forward-looking statements as a result of various factors. The information contained herein may not be considered as economic, legal, tax, or other advice and users are cautioned against basing investment decisions or other decisions solely on the content hereof.

This report provides an in-depth overview of the state of the cryptoasset industry over the last few months — offering our view on the industry and a recap of the most important news items. In addition, we have included one of our research reports: Our insights into Valuation Frameworks, The Case for Cryptoassets.

We hope our writing and research can guide you over the next few months by helping you better understand the cryptoasset industry.

State of Crypto Report by
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