

Throughout the lifetime of Bitcoin and Ethereum, there has been constant debate around how to think through valuation methodologies and comparative analysis of the two leading crypto protocols. This report attempts to quantifiably breakdown the historical behavior of BTC, ETH, and other crypto assets relative to traditional assets and benchmarks, as well as look at crypto native valuation methodologies for each.

## Key Takeaways

- Ethereum and Bitcoin trade at a very high correlation. Historically ETH has traded with a high beta to BTC, but over the last 12 months has shown remarkable relative strength to BTC despite a market wide drawdown
- Bitcoin and Ethereum have both shown increased correlations to M2 money supply and net liquidity conditions post March 2020
- The clearest positive correlation to BTC/ETH is the Nasdaq, while the clearest negative correlation to BTC/ETH is the DXY
- Bitcoin valuation methodologies include Scarcity, Production cost, Market Cost Basis', and Transactional activity
- Ethereum valuation best simplistic valuation methodologies include measures of network activity, with our favorite being Market Cap / Network Fees

## Correlations

To start we will take a look at correlations Bitcoin and Ethereum have undergone throughout their lifetimes, measured by weekly and monthly data points of TradingView's "Correlation Coefficient" with values ranging from -1 to 1. The methodology for Tradingview's correlation coefficient can be found [here](#). According to their website, the coefficient is calculated by:

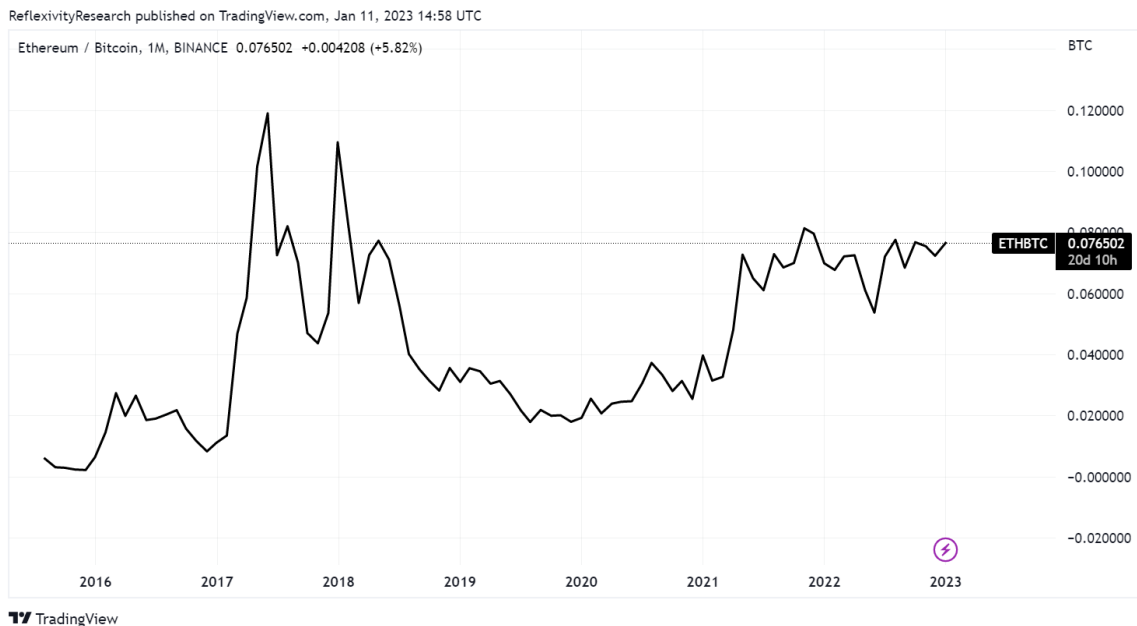
1. Calculating the Variance for both securities.  $\text{Variance} = \text{Squared Average} - (\text{Average Value} * \text{Average Value})$
2. Calculating the Covariance of the securities.  $\text{Covariance} = (\text{Average Value of Security1} * \text{Security2}) - (\text{Security1 Average Value} * \text{Security2 Average Value})$
3. Calculate the Correlation Coefficient.  $\text{Correlation Coefficient} = \text{Covariance} / \text{SQRT}(\text{Security1 Variance} * \text{Security2 Variance})$

## Ethereum and Bitcoin Relative Performance/Correlation

Before diving into correlations to external baskets/indexes, it is first worth exploring the internal dynamics between Bitcoin and Ethereum. Since Ethereum's inception, it has historically performed with an extremely high correlation to Bitcoin, essentially acting as beta to BTC. In layman's terms, when BTC price has risen, ETH has risen more than BTC and when BTC price has dropped, ETH has dropped more than BTC.

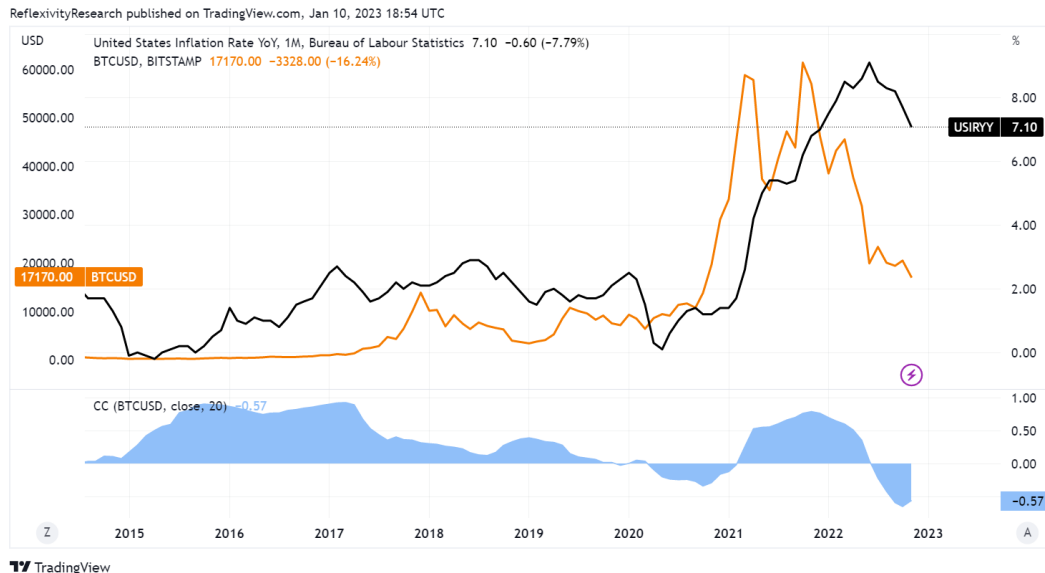


This high beta to Bitcoin caused ETH to dramatically underperform into the 2018 bear market. However, one key difference this bear market has been that Ethereum has held up quite well on a relative basis. This is expressed by looking at the ETH/BTC ratio, a simple ratio of the price of 1 ETH to 1 BTC. Throughout the market wide decline in the overall crypto market, ETH/BTC has shown resiliency, reaching multi year highs of 0.076 at the time of writing. Ethereum has also held its June price lows while Bitcoin broke below its June price lows in the wake of the FTX collapse. This may reflect the merge, which has shifted the underlying supply dynamics of Ethereum into a deflationary state upon any uptick in network activity, while Bitcoin has undergone forced selling from miners over recent months.



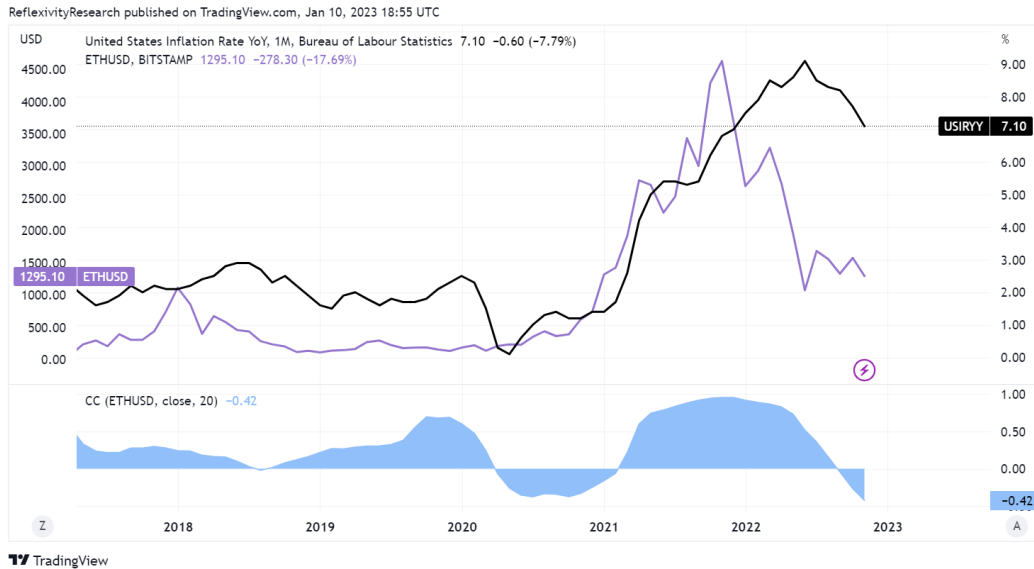
## CPI Inflation

Inflation is widely referred to by an index called the Consumer Price Index that aggregates a select basket of goods and services to create a standardized measurement of inflation. The scarcity of Bitcoin has generated many comparisons to gold, with market commentators dubbing the asset “digital gold”. Throughout the rapid rise of inflation in 2020/2021 measured by the year over year change in the Consumer Price Index, many individuals attributed Bitcoin’s positive performance to market participants recognizing the asset as being an inflation hedge. Looking at the historical correlation between Bitcoin CPI, we see a sustained regime of correlation in 2015-2017, followed by a decline and even inverse correlation throughout the early part of 2020. Following the liquidity injection into financial markets following the covid crash of March 2020, the correlation rapidly became positive again until declining into becoming negative in late 2022.



On the other hand, Ethereum shows a similar picture, with a positive correlation until early 2020, eventually flipping back into positive territory throughout 2021 and then eventually declining back into negative territory in late 2022.

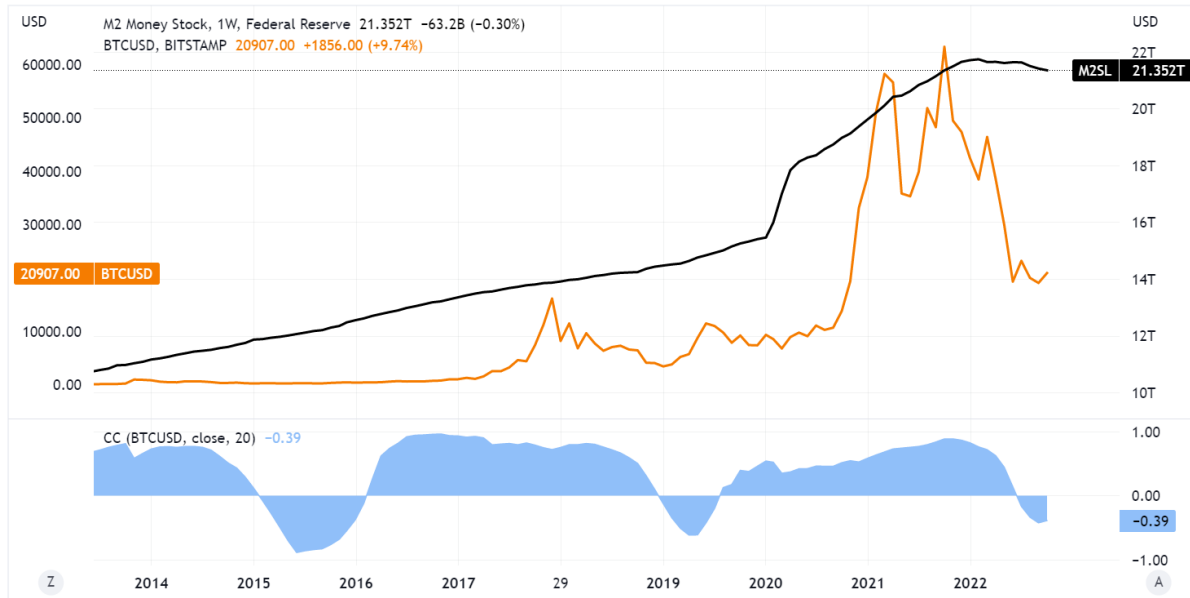
Overall, the correlation between both assets and CPI is constantly shifting and non-consistent throughout their lifetimes.



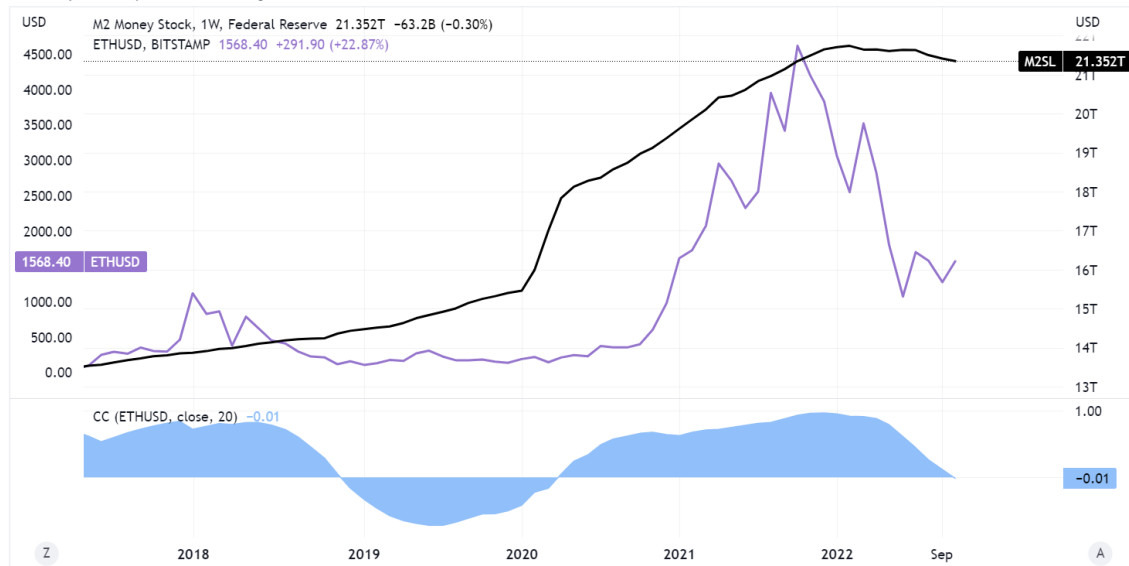
## M2 Money Supply

Next, we look at M2 money supply's relationship to the two leading crypto assets. Whereas M1 only looks at cash, checking accounts, and traveler's checks, M2 money supply includes cash on hand, money deposited in checking accounts, savings accounts, and other short-term saving vehicles such as money market funds and certificates of deposit (CDs). If we are to consider Bitcoin as a monetary debasement hedge instead of a consumer price index inflation hedge, this is one of the best ways to proxy such a potential relationship. Historically Bitcoin and Ethereum have both shown a high correlation to M2 money supply, with the exception of a few periods of short negative correlation in 2015, 2018, and now. With M2 having increased throughout the entire existence of both digital assets during the decade plus long period of zero interest rate and quantitative easing, it leaves question of whether this historical correlation has solely reflected the price action of the digital assets. Only recently in 2022 have we seen M2 decline during its first negative year over year change in 50+ years. As M2 has continued declining over previous months and Bitcoin/Ethereum consolidate around \$16K and \$1200 respectively, the correlation has interestingly declined. This leaves question of whether market participants are allocating to both assets to front run a theoretical monetary policy pivot that would lead to an increase in M2, or if the top two crypto assets have simply found an area that market participants perceive to be "value" for price action or crypto native valuation reasons.

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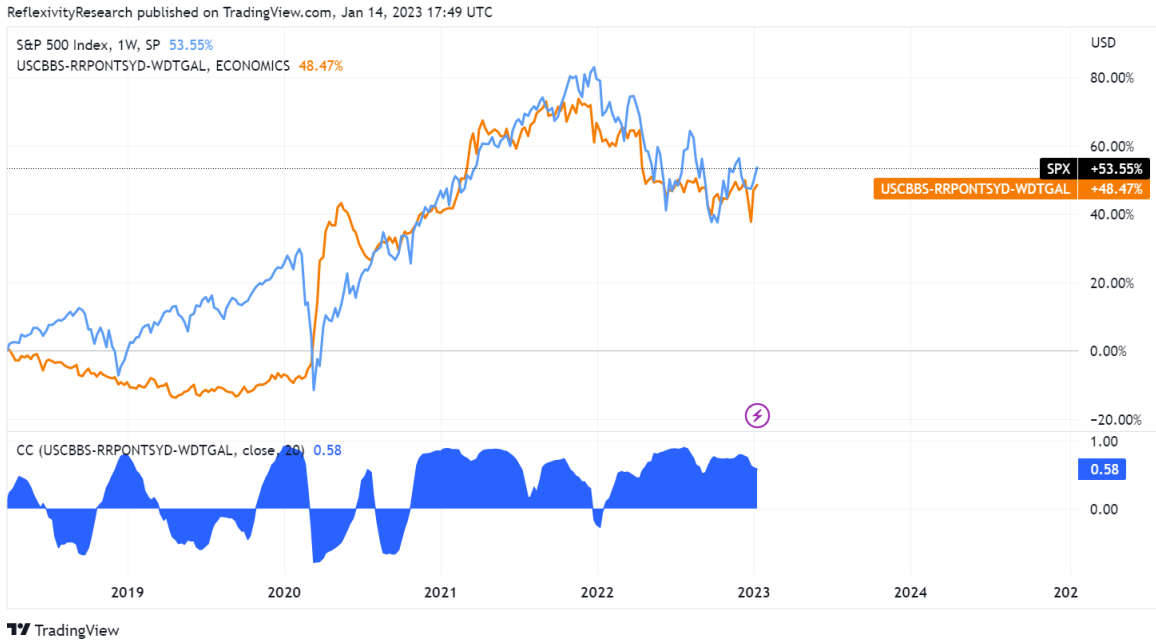
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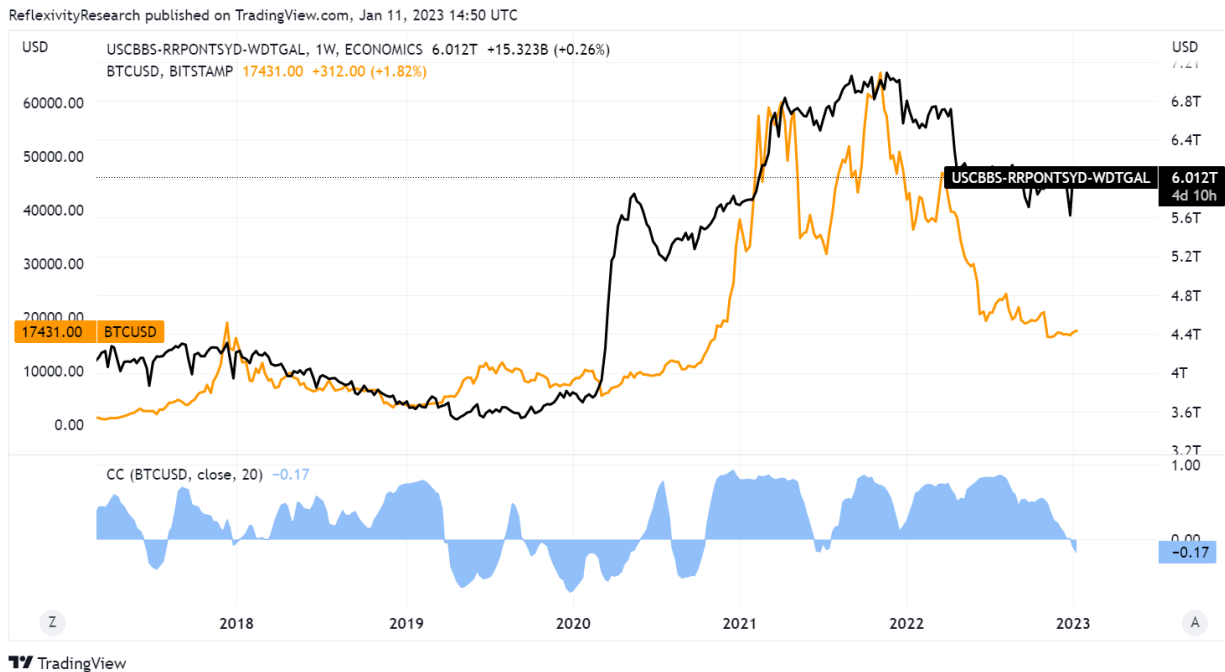
## Net Liquidity

While M2 money supply paints part of the overall liquidity picture, other factors such as deposits in the reverse repo facility and the treasury general account also affect overall market liquidity. To describe net liquidity conditions, we use the formula: Net Liquidity = Federal Balance Sheet - Reverse Repo Facility - TGA Assets. For a full deep dive into net liquidity, clients can refer to our previous [Net Liquidity Primer](#).

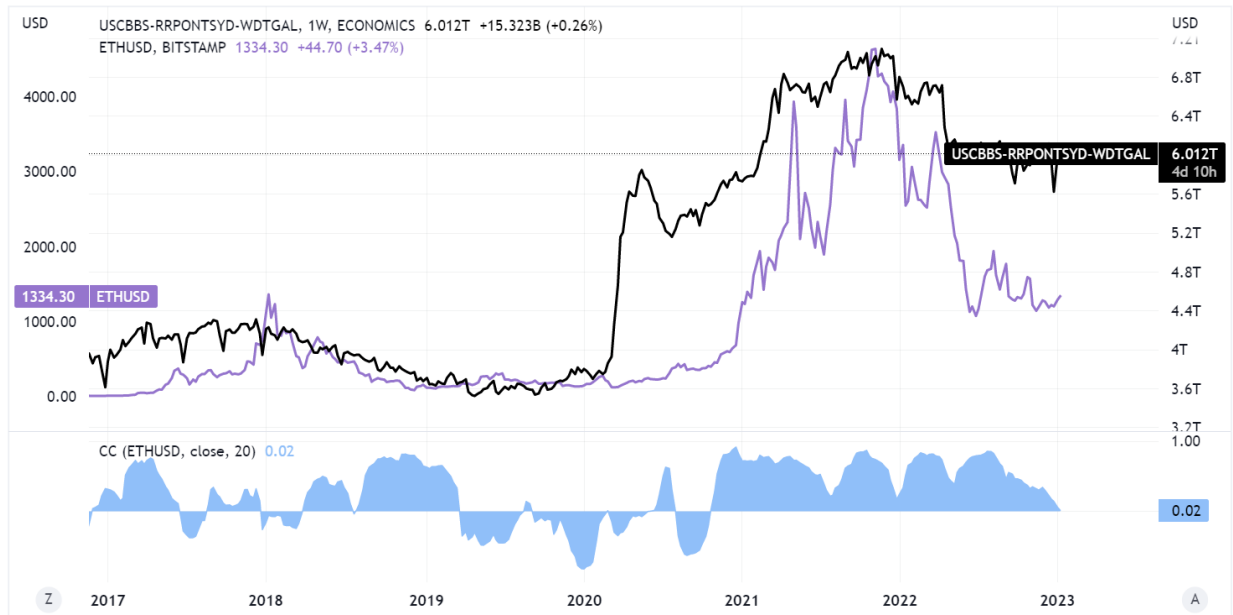
Overlaying net liquidity with the S&P 500 shows a very high correlation since the liquidity injection in response to the covid economic shutdown.



Bitcoin and Ethereum offer a similar look, with generally positive correlations to net liquidity conditions from 2021 to date.



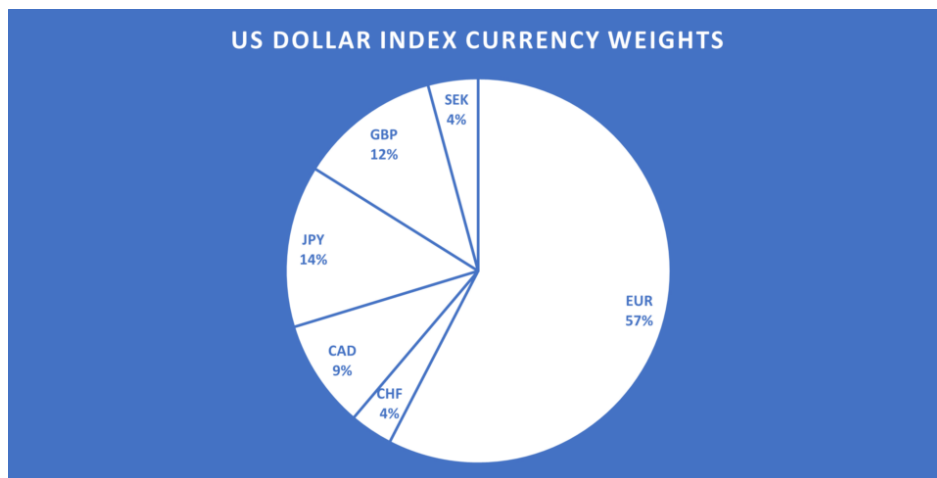
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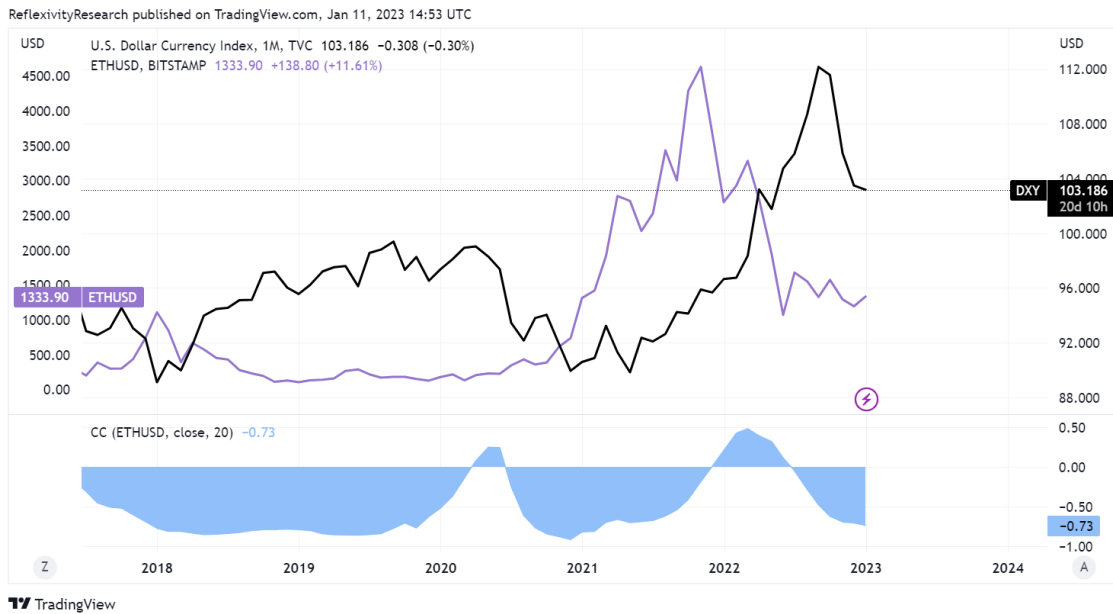
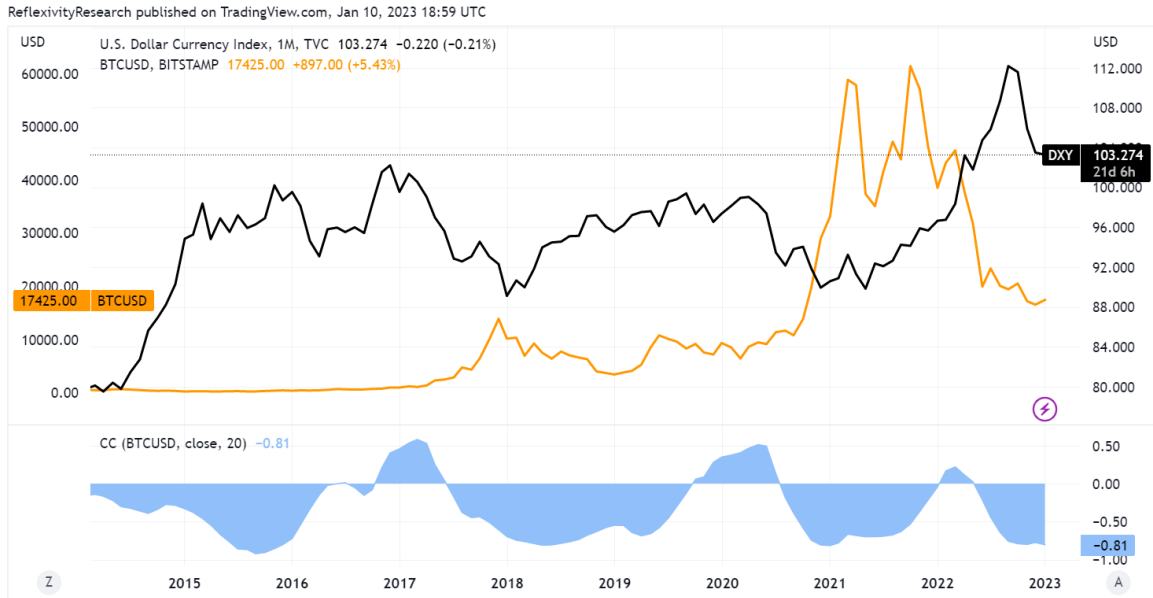
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## DXY

The DXY is a measurement of relative US Dollar strength against a basket of other global currencies, including the Euro, Pound, Yen, Swiss Franc, Canadian Dollar, and Swedish Krona.



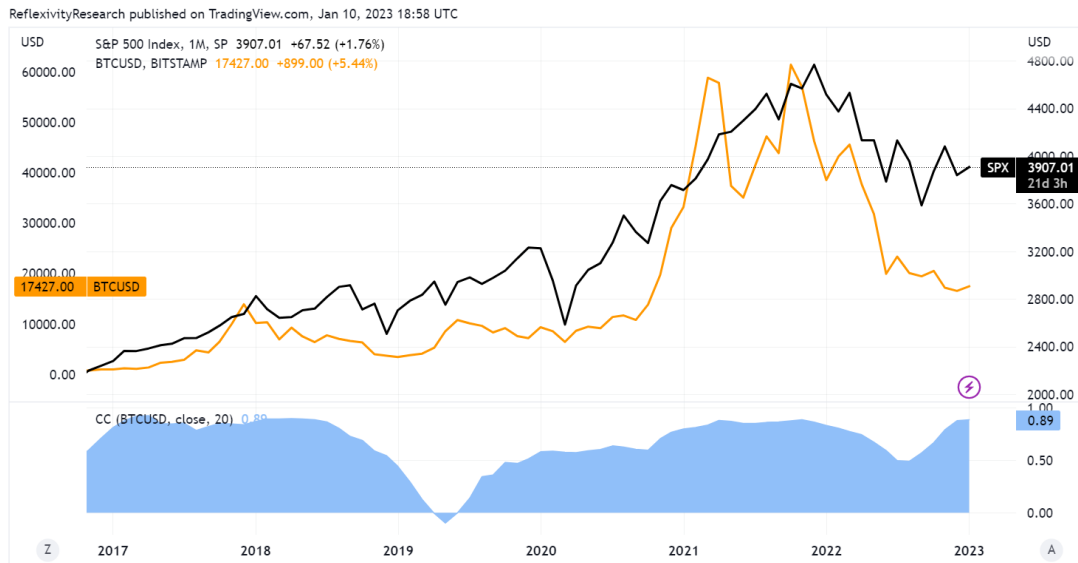
With many Bitcoin advocates expressing a view that Bitcoin is an alternative to the US Dollar that will eventually replace it as the global reserve currency, the DXY is a common marker that is used to gauge expected performance for Bitcoin's price action. Upon looking at the correlation between both Bitcoin and Ethereum to the DXY, we see a clear inverse correlation throughout the lifetime of each asset. Generally, dollar weakness has been bullish for crypto price performance and dollar strength has been bearish for crypto price performance.



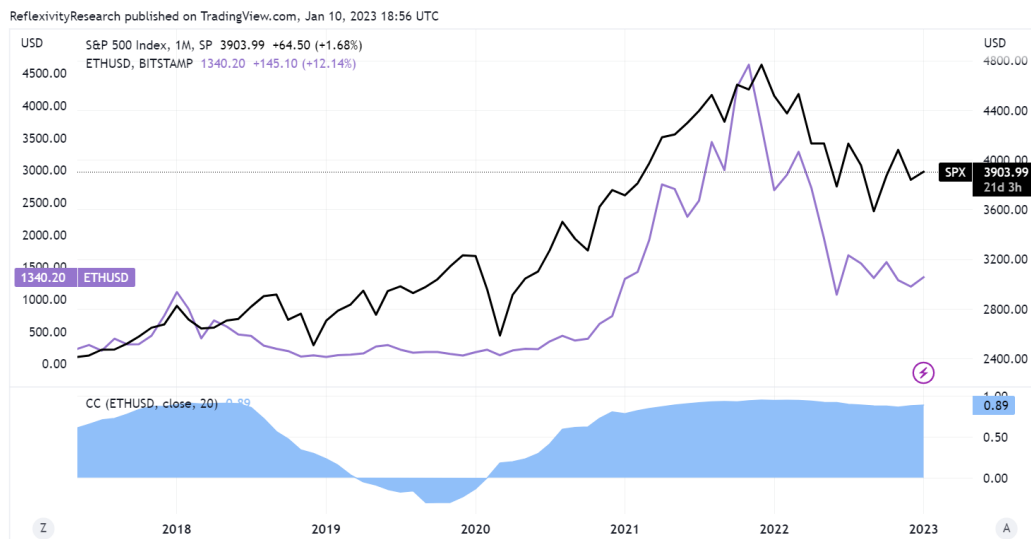
## S&P 500

The Standard and Poor's 500, or the S&P 500 index, is a basketed index of the 500 largest companies trading on the United States' stock exchange. This makes it widely regarded as the standardized way to measure asset performance in the United States and world broadly. Running a correlation between the S&P 500 and Bitcoin/Ethereum shows a very strong correlation, only flipping negative briefly in 2019 as Bitcoin short squeezed off the lows of its last bear market. The exact cause for this is partially up for debate, as one could argue in the post 2008 QE/ZIRP era liquidity conditions drive all asset prices and thus the stock market and crypto would show a strong correlation by

default. There is also a degree of risk tolerance embedded into crypto's performance driven by the stock market, as with a strong stock market, capital allocators are willing to go down the risk curve and acquire crypto assets that are perceived to be high risk.



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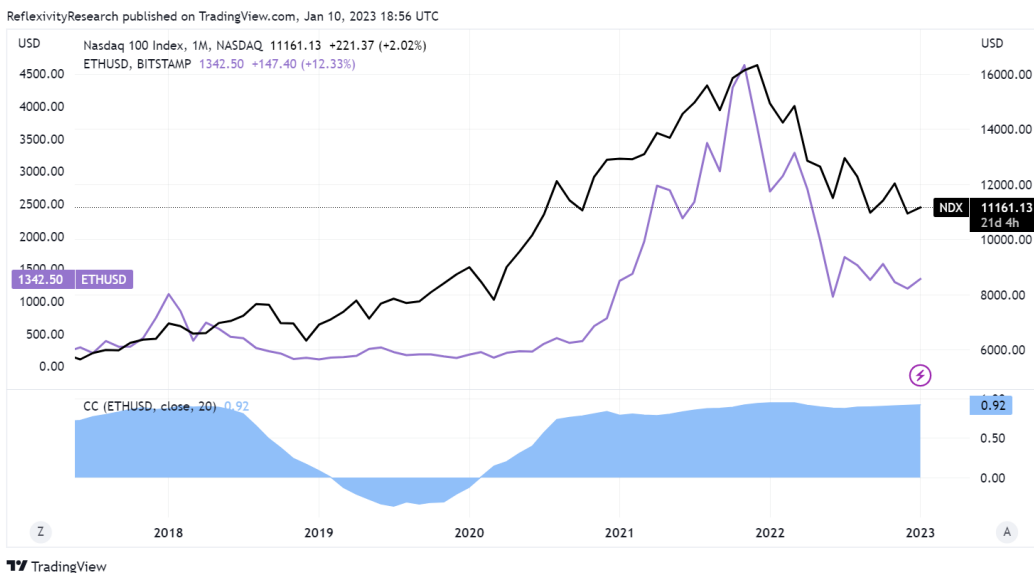
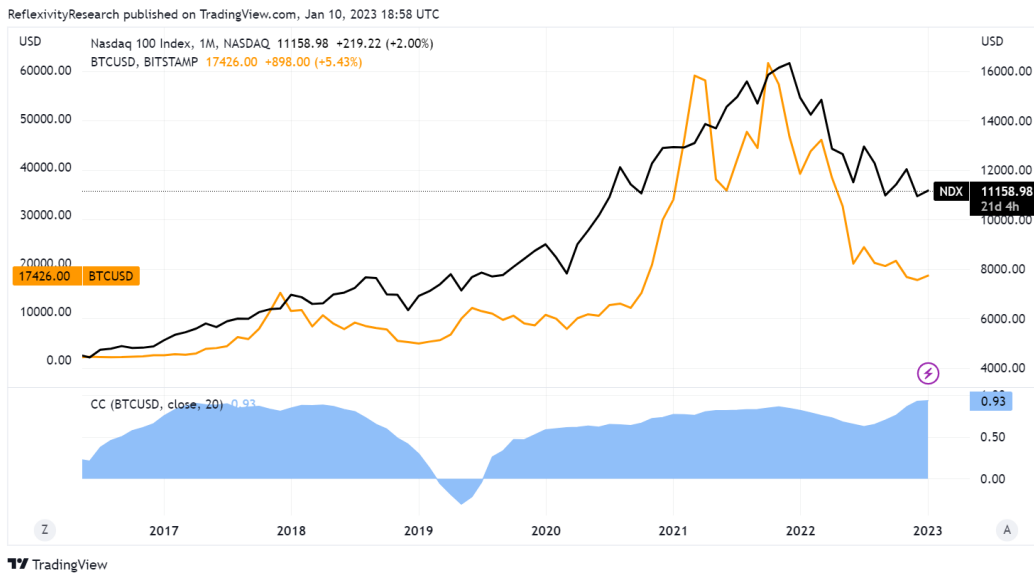
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## Nasdaq

Well known for being the most tech heavy stock index, the Nasdaq Composite consists of all of the companies listed on the Nasdaq stock exchange. To be listed on the Nasdaq, companies must meet requirements such as: Being listed exclusively on Nasdaq, being publicly offered on an established American market for at least three months, having a minimum of 1,250,000 publicly traded shares outstanding upon listing, the trading price of shares of the company's stock at the time of listing must

be at least \$4.00, having average daily volume of 200,000 shares, being current in regards to quarterly and annual reports, not being in bankruptcy proceedings. If companies lose these requirements, they will be delisted from the Nasdaq Composite.

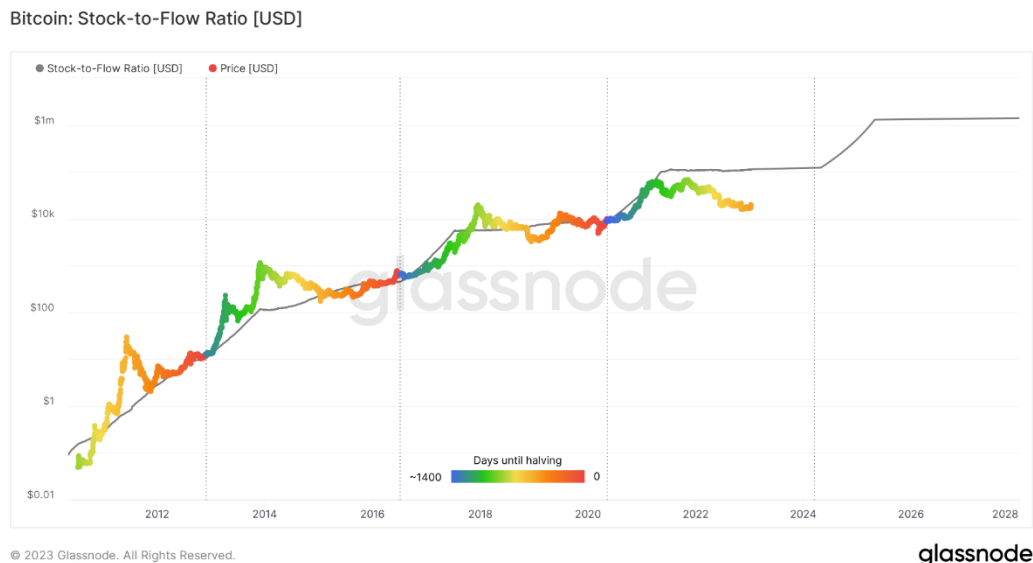
With the Nasdaq widely being recognized as the tech stock index, many compare its performance to crypto using the mental framework of crypto assets being high growth tech assets. The correlation between the Nasdaq and Bitcoin/Ethereum is the highest of all indexes/benchmarks described in this report, trumping that of the S&P. At the time of writing the correlation coefficient between the Nasdaq and Bitcoin and Ethereum respectively is 0.93 and 0.92.



## Bitcoin Valuation Methodologies

### Stock-to-flow

Originally released in a [medium article](#) in 2019 by PlanB, one of the most widely known valuation models that has been used for Bitcoin is the stock to flow model. This compares the amount of supply in circulation to the amount of supply issuance of an asset over time. With Bitcoin's halvings taking place every four years, over time its stock to flow ratio perpetually increases. The model then generates an expected value of BTC with the formula:  $(0.4 * SF \text{ ratio} ^ 3)$ . This was an extremely popular model throughout 2020 into early 2021, but price began to diverge significantly from the model's expected value and at this its fair to conclude that Bitcoin's scarcity is not the sole factor that determines its price over the short to intermediate term.



### Market Value to Realized Value

The next methodology used to describe relative under or overvaluation for BTC is utilizing realized value to create the market value to realized value ratio. Contrary to traditional market capitalization which can be calculated as (Marginal trading Price \* Outstanding Supply), realized value, or realized price, is calculated as (Each coin in circulation \* The price that each respective coin was last moved). For example, whereas 100,000 Bitcoin last purchased at \$1 per BTC make up roughly \$2 billion of Bitcoin's market capitalization; given that those coins last moved at \$1 they would only attribute \$100,000 to realized capitalization. This creates a value to represent the aggregated amount of value stored in the network. After dividing realized cap by circulating supply, this makes realized capitalization very similar to an on-chain

volume weighted average price in technical analysis, or as many on-chain analysts like to refer to the measurement as, the aggregated cost basis of the entire market. Whenever the marginal trading price is above realized price, the market in aggregate is in profit; and whenever the marginal trading price is below realized price, the market in aggregate is underwater. The chart below shows the ratio of Market price / Realized price; with the z-score adjusting the value for volatility. Whenever the value reaches a level above 7, historically this has signaled significant overvaluation. Whenever market price is below realized price and the ratio turns negative (highlighted by the green zone), historically this has signaled significant undervaluation.

Bitcoin: MVRV Z-Score



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## Estimated Electrical and Production Cost

Another valuation methodology for Bitcoin is tied into its underlying production cost. In theory a Bitcoin should at minimum be worth the costs associated with producing one unit of the asset. Production cost can vary for each individual mining operation based on a wide range based on the miner's energy input costs, insurance, rent, wages, and cost of capital. With that being said, any estimates for production costs are very rough, but one of the best attempts to do so comes from Charles Edwards of Australian hedge fund Capriole Investments. In the [article](#) describing the methodology, Charles uses data from Cambridge, which a few assumptions such as:

1. **The global average Bitcoin miner electricity price is \$0.05 USD per kWh.** Based on interviews with miners globally and consistent with other research, including [CoinShares](#)

2. **The energy efficiency of over 60 mining hardware models since 2014.**  
*Per manufacturer specifications and refined based on expert advice (to account for actual usage and overclocking)*
  
3. **The global average Power Usage Effectiveness (PUE) of Bitcoin Miners is 1.1.** PUE is a measure of the total energy required to operate mining facilities (including cooling) relative to the energy required for server operation. Cambridge came to this figure based on interviews with miners globally. It is also in-line with [Google's average PUE of 1.11](#)

This gives the lower bound of the oscillator, which is solely the estimated electricity cost for one Bitcoin. Applying an electricity cost to total cost ratio of 60% based on Cambridge's data on mining capex and opex gives the upper bound of the oscillator. Combining the lower bound (electrical cost) and upper bound (production cost) gives us the following: Bitcoin's estimated electrical cost is \$16,900 and estimated total production cost is \$28,200.



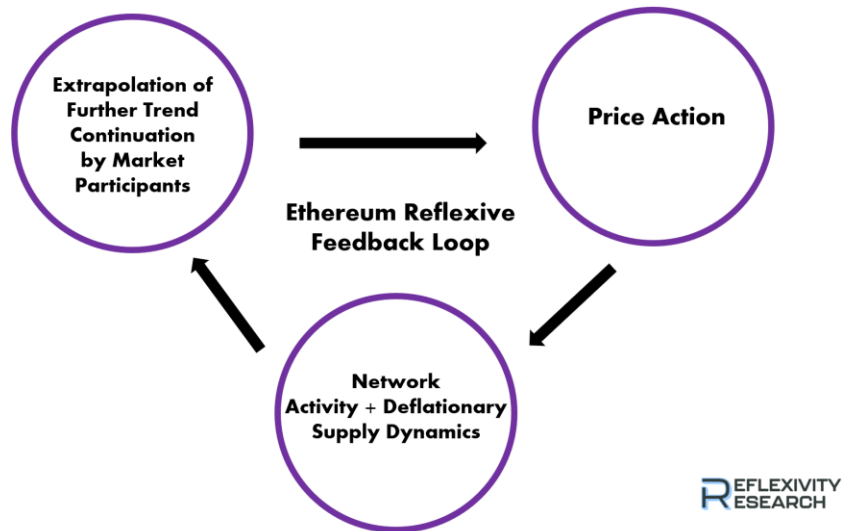
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## Ethereum Valuation Methodologies

While market participants have struggled to find an agreed upon valuation methodology for Bitcoin, which is a relatively "boring" non-complex protocol compared to other crypto assets, frameworks to value Ethereum as a smart contract protocol/commodity like gas use for base layer of decentralized financial services/now deflationary asset, are even more widely disputed.

## Network Activity

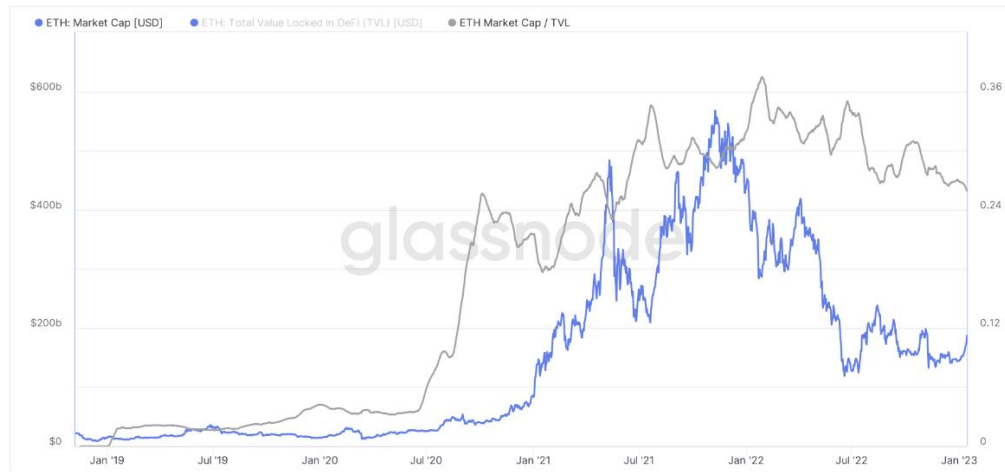
The primary drivers of Ethereum's value include speculation of future network usage, demand for gas to operate in the protocol, and with the recent change to ETH's supply dynamics speculation of Ethereum's value of a form of deflationary money. Ethereum likely performs tremendously well in the coming years as a reflexive feedback loop can begin between price, network usage/activity, and its supply dynamics.



## Market Cap / TVL

One indication for financial activity on the Ethereum network is a metric called Total Value Locked (TVL). This gives a representation of the total amount of crypto assets that are locked in DeFi protocols built on top of Ethereum. While measured in USD terms, this value is partially driven by ETH's price action itself, but nonetheless is still a valid indication of appetite to conduct financial activity on the smart contract platform in our view. While this is interesting and shows an increasing amount of financial activity on DeFi relative to the size of Ethereum's market capitalization over time, it perhaps does not offer any utility for active management and valuation.

ETH: Market Cap / Total Value Locked in DeFi



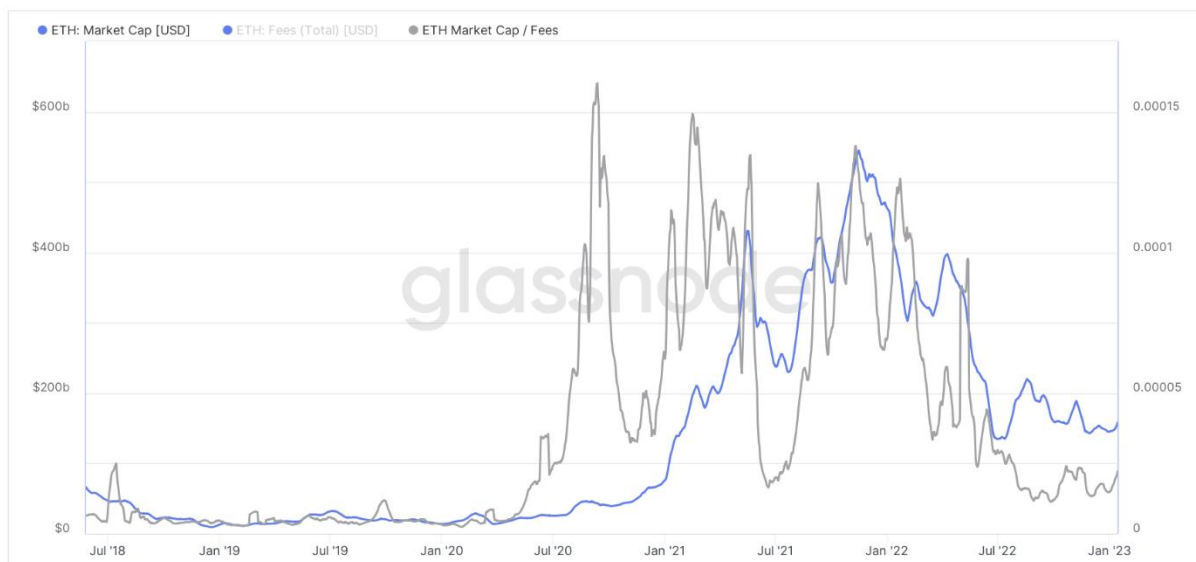
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## Market Cap / Fees

The simplest representation of Ethereum valuation in our view is to look at total fees on the network relative to the market capitalization of the network. This is the closest version to a traditional valuation framework for an equity such as a price to sales or price to earnings ratio. According to this valuation framework, Ethereum is currently relatively undervalued to levels it has reached over the last few years, although not quite as undervalued as levels reached in the 2018/2019 bear market.

ETH: Market Cap / Fees



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