CANE ISLAND

Bitcoin Algorithmic Standard Equilibrium (BASE) Index

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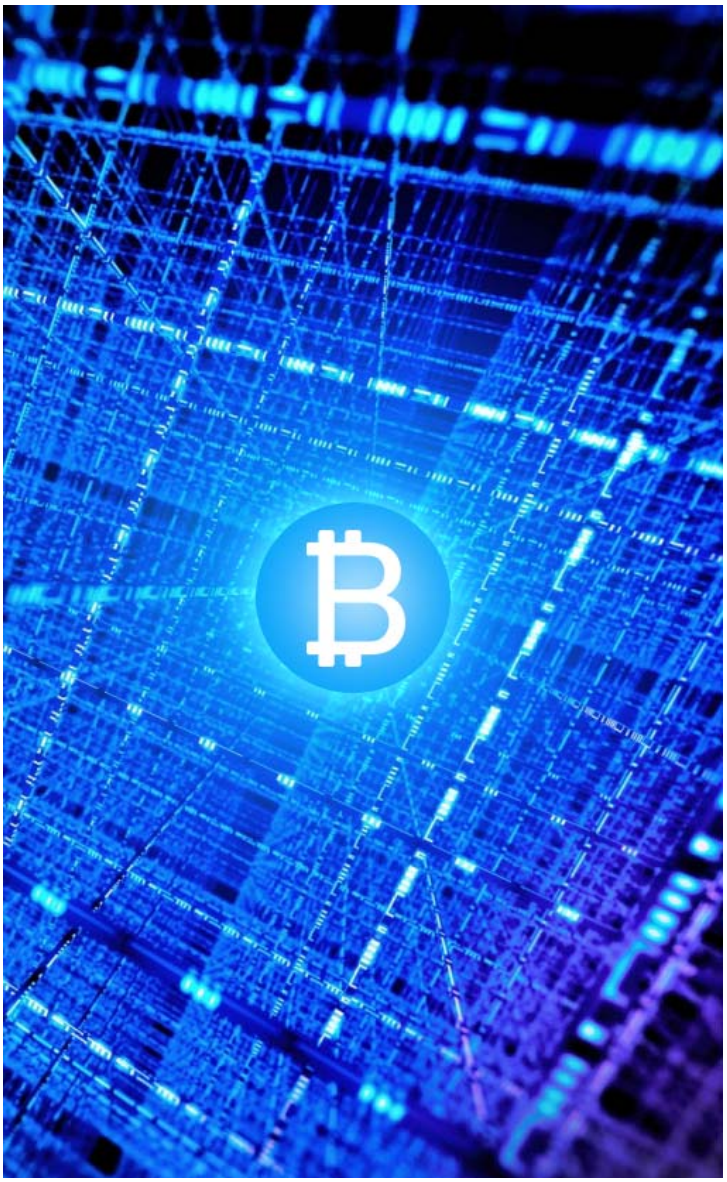


An Investment in Knowledge

The Cane Island Bitcoin Algorithmic Standard Equilibrium (BASE) Index is a measure of the theoretical fair value of a bitcoin to the U.S. dollar. It is based on established and widely accepted mathematical and economic principles of network economics and monetary theory.

The BASE Index is designed to provide an indicator of bitcoin's fair value, under conditions of normal supply and demand, for periods of 60 days or longer. The Base Index is a mathematical construct, so it may not be invested in directly. The BASE Index is used to evaluate the price of bitcoin traded in public markets relative to an objective standard representing an equally motivated buyer and seller under normal market conditions and fair competition. The BASE Index is not designed to track movements of bitcoin or any particular asset. Other uses include evaluation of portfolio performance, and forensic detection of bitcoin price manipulation in public markets.

NETWORK ECONOMICS

Traditional currency models fail with bitcoin. By design, bitcoin is intentionally disconnected from direct government oversight, fiscal policy, and monetary policy. But various mathematical laws which explain network connectivity offer compelling explanation of bitcoin's value.

Network economics is an emerging field within the information society. Its premise is that products and services are created and value is added through networks operating on large or global scales. This is in sharp contrast to industrial-era economies, in which ownership of physical or intellectual property originated from a single enterprise.

A network's value is directly proportional to the square of the number of users. The simplest example of network economics is a telecommunications network such as social media. A social network with ten people is not very valuable. But for each user added, all existing users benefit because they may all share information with that new user.

In a New York Times article, Varian [2014] raises a fundamental question: why are the dollar bills in people's pockets worth anything? According to Varian, there are two possible explanations for this: (a) the dollar bills carry value because the government in power says so and (b) because people are willing to accept it as payment. He concludes that the value of a dollar comes not so much from government mandate as from network effects.

Financial networks also add value through the addition of new transactions. Financial networks are comprised of offers to buy and sell. Each bid or ask provides valuable information not just to the prospective parties of the transaction, but to all others in the network as well. Just as in a social network, the addition of a new component (say a new trader or investor) affects positively the complementary component of the Bitcoin ecosystem by providing additional competing offers.

METCALFE'S LAW AND BITCOIN'S VALUE

Bitcoin's price is best modeled as a network. Metcalfe's law, adjusted for the creation of new bitcoins over time, is well-suited to this task. This approach provides insight into the long-term value of bitcoin, but it does not attempt to explain short term price movements, which can be driven by a multitude of factors.

Metcalfe's law is based on the mathematical tautology describing connectivity among *n* users. As more people join a network, they add to the value of the network exponentially. The underlying mathematics for Metcalfe's law is based on pair-wise connections (for example, telephony). If there are four people with telephones in a network, there could be a total of 3 + 2 + 1 = 6 connections. The addition of just one more person nearly doubles the number of connections to 11.

This law, like most other laws, assumes equality among the members' network connections. This assumption is met for Bitcoin, because each bitcoin user transacts only in bitcoin.

The full math for Metcalfe's reasoning leads to the sum of all possible pairings between users (*n*), so the value of the network is

$$\frac{n(n-1)}{2} \tag{1}$$

Metcalfe's law includes a constant of proportionality factor. For valuation of bitcoins, this is expressed in terms of transactions (*t*) per user.

$$P = \frac{n(n-1)}{2} \times \frac{1}{\sqrt{t}/n} \tag{2}$$

To arrive at an accurate value for bitcoin, Metcalfe's value must be adjusted for rate of creation of new bitcoins (*r*). This rate of creation is used as a deflator, so that the final model becomes

$$P = \frac{n(n-1)}{2} \times \frac{1}{\sqrt{t}/n} \times \frac{1}{1+r} \tag{3}$$

RELATIONSHIP TO QUANTITY THEORY OF MONEY

The quantity theory of money states that there is a direct relationship between the quantity of money in an economy and the level of prices of goods and services sold. The Fisher equation quantifies this relationship as

$$P_{BTC|USD} = \frac{Q \times V}{T} \tag{4}$$

The value of bitcoin (versus dollars) is proportional to the inverse, or

$$P_{USD|BTC} \propto \frac{T}{Q \times V} \tag{5}$$

where T is transactions (Metcalfe value), Q is the money supply of bitcoins (n), and V is velocity of money, or transactions per user $\sqrt{t}/n$

INDEX DATASET AND HISTORY

The Bitcoin distributed ledger, implemented through blockchain, provides perhaps the most robust transaction dataset in history. Every transaction since Bitcoin's inception is recorded and publicly available in the blockchain. Distributed across a wide network with an inherent validation process, the blockchain is immutable, and therefore its integrity is exceptional.

The Cane Island BASE Index model requires only three datasets: wallets, number of bitcoins created, and daily transactions. The equilibrium value index calculation does not rely directly on past price history of bitcoin. It is not a moving average or technical measure of price.

The index genesis date is December 31, 2011. The US dollar is the reference currency.

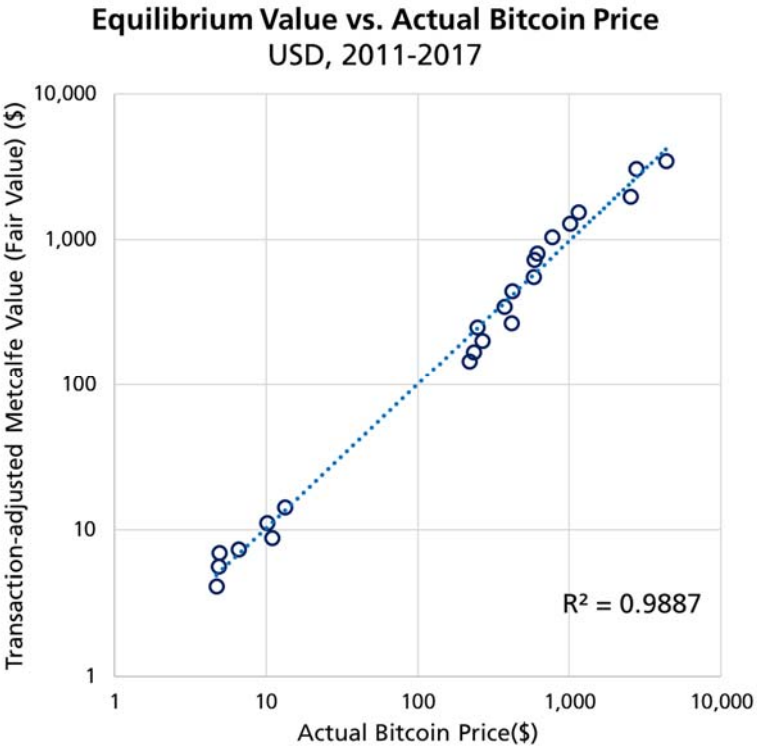
Research conducted by Gandal et. al [2017] analyzed the impact of suspicious trading activity on the Mt. Gox bitcoin currency exchange between February and November 2013. They observed two distinct periods in which approximately 600,000 bitcoins valued at $188 million were acquired by agents who did not pay for the bitcoins. During the second period, the U.S. dollar-bitcoin exchange rate rose by an average of $20 at Mt. Gox bitcoin exchange on days when suspicious trades took place, compared to a slight decline on days without suspicious activity. The authors concluded that the suspicious trading activity caused the unprecedented spike in the U.S. dollar-bitcoin exchange rate in late 2013, when the rate jumped from around $150 to more than $1,000 in two months. Gandal's work is crucial because it means that pricing during that period was not the result of normal market conditions. Gandal's statistical analysis of trading patterns imply the odds of such daily price anomalies to be less than one in several million. Our own research concluded that the high price in 2013 would have naturally occurred only once in every 13,000+ years. Accordingly, our model discards prices from the 2013-2014 period on the basis they are not indicative of free market forces of supply and demand.

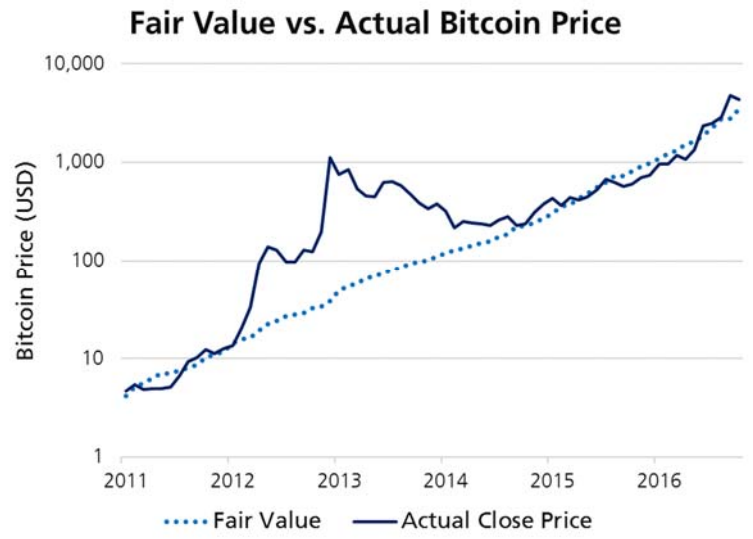
INDEX METHODOLOGY AND CONSTRUCTION

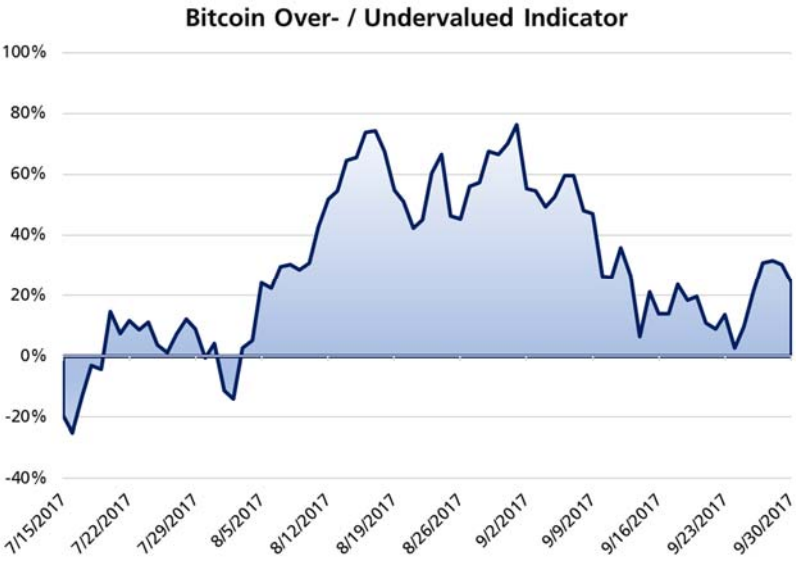
The index baseline coefficients are determined by selecting independent variables at 60-day intervals, commencing with 31 December 2011 and ending 30 September 2017, excluding periods from 2013 through February 2015.

Bitcoin price and Transaction-adjusted Metcalfe value are converted to lognormal values. This transformation is necessary for several reasons. First, the use of lognormal returns is common practice when dealing with currency returns. The choice of reference currency dictates the denominator of the rate-of-change calculation. Currency pairs trades are zero-sum results where one side's loss is equally offset by the other side's gain. The use of lognormal values ensures this condition is met by negating the effect of choice of reference currency on return. Second, bitcoin is constantly traded, day and night, and knows no holidays, trading halts, or other stoppages. Lognormal values are best suited to capture what is literally the continuous function of bitcoin price formation.

The results are standardized to minimize root mean squared deviation (RMSD). The slope and intercept of the resulting fit is applied to all periods since 31 December 2011. Cane Island reserves the right to modify the slope and intercept values but has no plans to do so.







DISCLOSURES

The index is constructed with backtested performance. It is hypothetical (it does not reflect trading in actual accounts) and is provided for informational purposes only to indicate historical performance. The index is updated weekly, with daily values. Monthly values are available to be viewed at www.rstatllc.com.

Actual performance for portfolios managed against the index may be materially lower than that of any index. Backtested performance results have certain inherent limitations. Such results do not represent the impact that material economic and market factors might have on an investment adviser's decision-making process if the adviser were actually managing client money. Backtested performance also differs from actual performance because it is achieved through the retroactive application of a model designed with the benefit of hindsight. As a result, the models theoretically may be changed from time to time and the effect on performance results could be either favorable or unfavorable.

As with any investment strategy, there is potential for profit as well as the possibility of loss. Cane Island does not guarantee any minimum level of investment performance or the success of any index portfolio or investment strategy. All investments involve risk and investment recommendations will not always be profitable.

Past performance is not necessarily indicative of future results

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