
BNC.
AN INTRODUCTION TO
THE GENERAL TAXONOMY
USE CASE SERIES
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About Brave New Coin

Brave New Coin's mission is to be the leader in delivering the most accurate, accessible, and comprehensive blockchain data solutions and insights, in ways that anticipate and respond to the needs of an evolving market.

BNC is committed to providing the type of trusted information, technical analysis and research that will empower and inform stakeholders across the cryptographic asset marketplace.

To that end, The General Taxonomy for Cryptographic Assets has been curated to deliver on the goal of a comprehensive asset classification system which provides a common frame-of-reference for all sector participants.

Author Profile

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Estimating the "Fair Value" of Gold and its Relevance to Cryptographic Asset Valuation

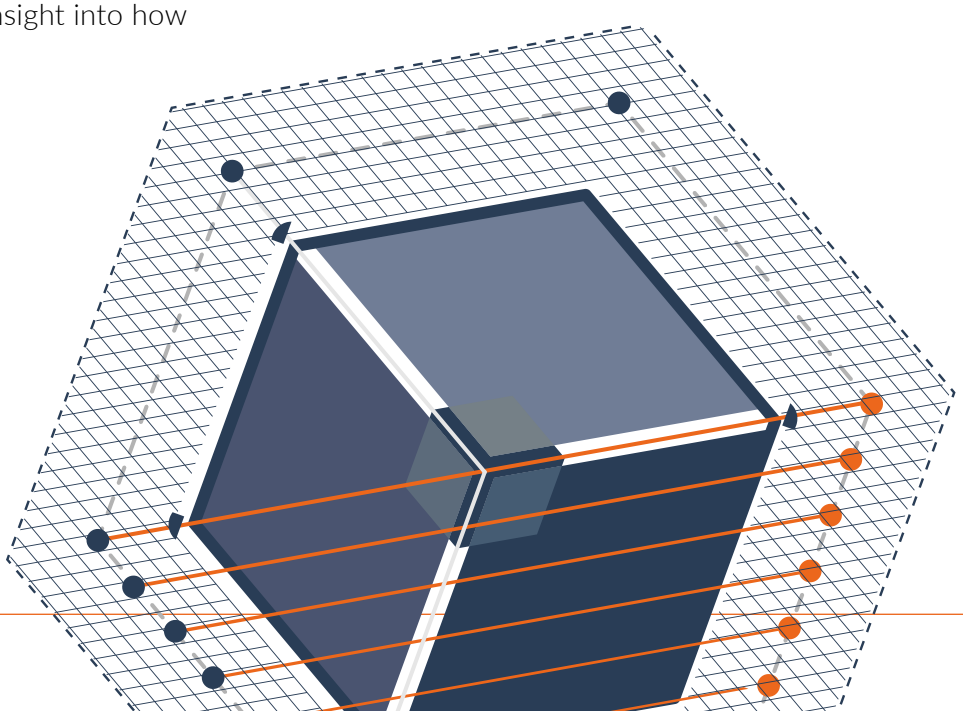
In mid-2017, Deutsche Bank analyst Grant Sporre released a report estimating the "fair value of gold" in which he contended that valuing gold is both art and science. Seeing gold as a simple commodity governed by supply and demand, he said, was insufficient to establish a satisfactory "fair value."

While it is possible to use a scientific framework for an estimation of gold's fair value, this value will change depending on the different use cases gold is assigned. Deutsche Bank's fair value estimations, for example, ranged from $735 to $1648 USD per ounce, depending on whether gold was seen as a store of value, a medium of exchange, a hedge against market turbulence, or a commodity. Averaging all of its models, Deutsche Bank arrived at $1,015 per ounce as a fair value estimation and concluded that gold is currently trading at a 20% premium to fair value because of "heightened perception of risk or uncertainty in the broader markets."

The intricacies of valuing this precious metal show that valuing crypto assets will likely prove just as difficult. However, Deutsche Bank's reasoning as to why gold was trading at a premium over its fair value estimate does provide a key insight into how to value cryptographic assets.

Just as gold's nature allows it to behave as both a commodity and store of value asset, the Brave New Coin (BNC) General Taxonomy for Cryptographic Assets contends these instruments can behave as either of these two superclasses of financial assets — and a capital asset as well. Indeed, a common theme among the most accurate valuations of bitcoin to date is the recognition of its asset versatility. The purpose of this article is to analyze the current crypto asset valuation methodologies used to estimate bitcoin's "fair value" and provide an update on the parameters and assumptions of the most accurate methodologies.

This article will also serve to introduce a series of use case articles showcasing BNC's newly launched General Taxonomy for Cryptographic Assets and illustrate how this tool can be incorporated into investment research of the cryptographic asset ecosystem. We will continue to explore this topic in weeks to come as we publish General Taxonomy for Cryptographic Assets case studies for asset managers, regulators, researchers, developers and enterprise.



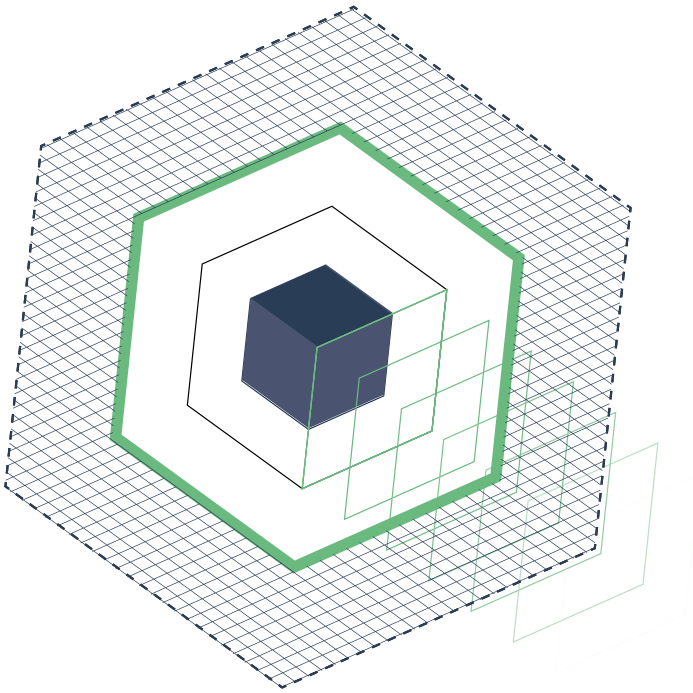
How NOT to Estimate Cryptographic Assets' Fair Value

Given the highly volatile nature of crypto assets, one of the least advisable valuation methods is that of a classical linear regression. In their 2016 investment case study for a Kraken-sponsored competition, Gosh, Haider and Kim measured the weekly price change of both bitcoin and ether to estimate the future weekly price changes for the year 2020.

The authors' methodology substantially underestimated the crypto assets' growth potential, estimating a price target of $1,360 for bitcoin and $26 for ether by 2020. Only eight months after their study, bitcoin doubled the study's price estimation while ether surpassed it by more than fifteen times.

This is not to say that traditional econometric regressions are always inappropriate for studying crypto assets. Ciaian, Rajcaniova, and Kancs, for example, make use of a general equilibrium model to estimate supply-demand interactions. However, the main difference between the studies is the use of a logarithmic transformation to rewrite the general equilibrium equation. Most importantly, Ciaian et al. do not use this model to forecast future prices but to estimate the effect, or statistical significance, of various supply and demand drivers for bitcoin's price.

Gosh et al.'s methodology also borrowed from Needham and Co.'s valuation methodology, which is based on projections of future demand for bitcoin as "digital gold" and as an alternative payment channel. However, without providing supporting reasoning, the authors reduced bitcoin's estimated market share of global Assets Under Management (AUM) in gold ETFs by 2020 from 25% to 15%, a modification that proved to be ill-fated. Eight months after both Needham's and Gosh, Haider, and Kim's estimates, bitcoin's market capitalization reached an all time high of $48.5 bn, of which $36.3 bn (75% of all bitcoins in existence) was held as "digital gold" according to Needham's 2016a and 2016b studies. Not only did bitcoin surpassed both estimates, it did so in less than a year, six times faster than estimated.



Cryptographic Asset Valuation Methodologies

While Wedbush Securities, Needham & Company, and Global Advisors have provided the most accurate bitcoin price forecasts, this article will only focus on Wedbush and Needham's approach since their valuation methodologies are publicly available. Wedbush for example, found bitcoin was undervalued by at least 30% during the bear market of 2015 and established a 12-month target of $400, subsequently revised to $600. In a similar fashion, Needham established a $655 price target at the end of Q1 2016 (with a spot price of $418 at the time), and then revised to a $848 target by the end of the year.

Both estimates used solid 'art and science' valuation approaches that resulted in accurate forecasts for bitcoin's price and potential returns. The scientific side of their valuation methodology relies on the Quantity Theory of Money while the creative side relies on answering questions in the form of "what if bitcoin represented a __ % of the _____ market?"

Wedbush focuses its analysis on three main applications where bitcoin can capture market share: payments (online, remittances, and micro-transactions), banking services for the traditionally unbanked sector, and a catch-all-other category that includes black market activity and any other future application. However, Wedbush only seems to take into account the U.S. market for its estimates.

Needham also focuses on the payment utility of bitcoin as a source of future demand, but unlike Wedbush, take their analysis to a more granular level by taking into account the global retail payment markets. These they divide into domestic and cross-border payments, and also by market maturity, arguing that bitcoin will experience a faster growth in cross-border payments of emerging markets.

Another key difference between Wedbush and Needham's approach is the inclusion of a "Digital Gold" demand source for bitcoin by the latter. Given Needham's estimates that 75% of all bitcoin in existence is held as a "digital gold" investment, it's arguable that their fair value estimate is more accurate overall as the permissionless and distributed nature of the asset allows it to be used as a unique insurance policy against market turbulence.

Indeed, if Deutsche Bank's premise that gold's current premium over its estimated fair price is due to a heightened perception of an increasingly unstable financial system, demand for bitcoin and store of value crypto assets in general is likely to grow faster than initially estimated.

This has already proven to be the case. Needham's 2020 target for bitcoin's market share of the global AUM of gold ETFs was topped in slightly over 12 months. In light of this, we will now provide an updated bitcoin valuation framework that builds upon Needham's methodology while also making use of Metcalfe's Law. First, Metcalfe's framework will be used to estimate the network's present value. Then, bitcoin's present fair value will be revised based on Needham's 2016 demand and transaction growth estimates. Third, we will test whether our updated target for 2020 is supported by both Needham's forecasts and Metcalfe's approach. As a final step we will discuss Metcalfe's Law for suitability as a framework for fair value estimation of crypto assets.

Metcalfe's Law states that the value of a telecommunications network is proportional to the square of the number of its connected users. Applying this methodology to the bitcoin network, Tim Swanson, Director of Market Research at R3, proposes using transactional data to gauge the number of users connected to the network.

As of the December 31st 2017, data from blockchain.info shows 290,422 confirmed bitcoin transactions for the day, with a market capitalization of $237.62 bn. Excluding the network's 100 most popular addresses results in 278,158 transactions, while only excluding long chains (coin mixers) instead results in 204,038 confirmed transactions for the day. Thus the fair price for each usage metric is as follows:

Table 1. Fair Value Estimation of Bitcoin based on Metcalfe's Law as of December 31st, 2017

Usage Metric	Number of Transactions	Current Market Cap	Current Bitcoin Price	Fair Market Cap	Fair Bitcoin Price
Total number of confirmed Transactions	290,422	$237.62 bn	$14,165.57	$ 84.34bn	$5,028
Total number of Transactions excluding 100 most popular addresses	278,158	$237.62 bn	$14,165.57	$ 77.37bn	$4,612
Total number of Transactions excluding long chains	204,038	$237.62 bn	$14,165.57	$ 41.63bn	$2,481

The results above show that bitcoin could be currently overpriced. However, even the lowest price level would still exceed by 35% the target of the global gold ETF market share suggested by Needham a little over 18 months ago. If this is the case, what market share of the global AUM of gold ETF's will bitcoin capture by 2020?

Rather than simply capturing market share from the global gold ETF's AUM, bitcoin is well positioned to secure share from the entire $7.3 trillion global gold market over the coming years thanks to a combination of its store of value nature and the current premium over the estimated fair price of gold caused by financial instability.

With gold's premium at 20%, approximately $1.4 trillion dollars are being stored in gold as a hedge against market turbulence — an amount we contend could transition to bitcoin by 2020 as a way to offset broader financial risk.

This would represent a 5-fold increase from its December 31st market capitalization, which amounts to 19% of the total gold market, and a monetary base of $1.4 tn for bitcoin. There will be 18.375 million bitcoins in existence by that time, dividing this projected monetary base by the circulating supply we arrive at a $76,190 valuation by late 2020. The next step is to bring this estimate to present value. Wedbush uses a 40% discount rate for a 10-year horizon while Needham uses a 25% for a 4-year horizon. Using a 40% discount rate as a proxy for a "higher uncertainty scenario" and a 25% discount rate as "lower uncertainty scenario" we arrive at a present valuation of $27,766 and $39,000, respectively.

While valuing bitcoin using Metcalfe's framework shows a clear divergence between price, market capitalization and transaction volume, the 2020 price estimates based on bitcoin's use as digital gold place the asset still in undervalued territory. It is worth noting that daily bitcoin transactions display a high degree of variability, the standard deviation of the historical time series is 102,583, or roughly 35% of the total transactions for December 31st. Additionally, the coefficient of variation, a statistical measure of dispersion around the mean, for daily transactions is 154%. Hence the extreme dispersion of the daily transactions in the bitcoin network should make Metcalfe's methodology a complementary framework in the investor's toolbox rather than being an isolated valuation technique.

Bitcoin Price Target for 2020

Just how likely is our updated $1.4tn monetary base for bitcoin by 2020? Metcalfe's framework tells us that the network would have to process at least 1.2 million daily transactions for bitcoin to reach the target monetary base. This represents an increase between 300% to 500% of current daily transactions, as of December 31, 2017, depending on whether you take into account popular addresses and long chains.

Needham's projected transaction volume growth for 2020 actually backs up this updated price target. In their Q3 2016 report they estimate a 400% transaction volume growth between late 2017 and late 2020, a middle ground between the required 4 to 6-fold increase. This in turn would translate to a fair price estimate of $78,538, a figure that is off by 2.8% from our earlier estimate should bitcoin capture the current premium allocated to gold as a hedge against market turbulence.

Under Metcalfe's framework this would translate to a fair price estimate between $41,120 to $78,538, with the higher range of this valuation falling 3% off the 2020 estimate using the approach inspired by Wedbush and Needham's.

The Economic Intuition behind Metcalfe's Framework

To finish this analysis, we want to know whether Metcalfe's Law is an appropriate valuation approach for bitcoin and crypto assets in general. That is, we want to establish whether the number of users connected to the network is only correlated, or is actually cointegrated, to bitcoin's market capitalization. Statistical correlation and cointegration are common concepts, albeit sometimes misused, in the trading community. While correlation identifies two time series that move in either tandem or opposing directions, cointegration measures whether or not the distance (spread) between them remains stable over time. If transaction volume and market capitalization are only correlated, they will move in the same direction but the spread between the two can grow indefinitely. Cointegration, on the other hand, implies that the time series are a stationary pair (the spread is fixed) and hence statistically they are mean reverting.

If both metrics are cointegrated then it is possible to incorporate both short-term price dynamics (deviations from equilibrium) and long-run expectations (corrections to equilibrium).

Cointegration is also the foundation upon which pair trading ("statistical arbitrage") is built, so as the overall crypto market matures and more derivative products are created around crypto assets this type of analysis will become more commonly used.

After performing a Box-Cox transformation on both bitcoin's market cap and transaction volume time series, Johansen's test of cointegration confirms both metrics have a long-run relationship. This makes it possible to estimate and forecast the speed (and direction) at which the time series correct themselves from short-run deviations and long-run corrections toward equilibrium.

Closing Remarks

As mentioned at the beginning of this article, there is no silver bullet methodology when it comes to valuing assets with a mercurial nature as is the case with both gold and crypto assets. In the case of bitcoin specifically, however, there are valuation frameworks that have proved more reliable than others. This article has identified the most consistent methodologies to estimate a fair value for bitcoin and provided an updated 2020 price estimation based on the network's performance during 2017 and Needham's adoption forecasts as "digital gold" or a safe haven asset.

In addition to these approaches, given the cointegration confirmation between transactional volume and market capitalization, Metcalfe's framework can also be a valuable tool to estimate bitcoin's present and future fair value, that is, short-term price dynamics and long-run corrections to equilibrium. There are many important areas for future research on the topic of bitcoin's fair value estimation, and cryptographic assets in general. For example, defining whether to exclude either popular addresses and long chains from fair value estimations, the impact in valuation of extreme dispersion in daily bitcoin transactions, as well as analysing whether a circulating or total approach is better suited for these forecasts.

Finally, the present article did not explore two additional areas where bitcoin, and cryptographic assets in general, can directly compete with existing infrastructure: the $3.2+ trillion hedge fund market and the broader $80+ trillion M2 global money supply. This will be the subject of the upcoming use-case series. For this we will continue using the valuation methodologies featured in this article to create a basket of crypto assets that are positioned to capture market share from the global gold markets, in addition to payments, asset management and physical M2 money supply.

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