# Measuring the Intrinsic Value of Cryptocurrency

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## Abstract

What is the intrinsic value of a bitcoin ("BTC")? Thus far, institutions and analysts have been searching for a valuation methodology by looking to other assets, often drawing on methods that are not applicable to this emerging asset class. This paper introduces a framework with which the intrinsic value of a cryptocurrency can be calculated. It discusses why traditional valuation methodologies are inaccurate and why the basic measure of market capitalization used today is flawed. It then discusses the idea of how one should logically approach the valuation and how not all use cases should be an added variable to calculate a possible market capitalization. Rather, these use cases should be looked upon as a variable that increases the value of each individual coin by reducing the total number of "Active Coins," or coins used within the network for payments.

## Background

The rise of cryptocurrency began on January 3, 2009, when the Bitcoin network went live and the genesis block began the blockchain. Since then, adoption and growth has sent prices skyrocketing from fractions of a penny per BTC, to a high of over $1200 in November of 2013. In addition to Bitcoin, Litecoin was introduced in October 2011, improving on the decentralization of the mining process. Since then, well over 200 different coins have propagated the cryptocurrency universe, including those with new innovations, direct clones of existing currencies, meme coins, scam coins and coins for any given purpose. As the ecosystem of cryptocurrencies rises beyond the days of illiquidity and become common in use, so should methodologies used to understand the value of a cryptocurrency relative to fiat.

As it stands, most methods derive a valuation based on a sum of capitalizations of companies, money supply, or as a percentage of an industry's market size. However, these methodologies are flawed and a new way of valuing cryptocurrency must be explored in order to accurately judge value.

## Currently Utilized Techniques

In early December 2013, Wall Street research departments began issuing price guidances on the value of 1 BTC. Wedbush Securities derived a maximum market cap based on Bitcoin's use as a sovereign currency alternative and added its potential value as a replacement to gold.[1] Bank of America then issued a report calculating a valuation with its use as a payment and money transfer platform and store of value.[2] Many other institutions began to gauge potential value simply by using GDP or a company's market capitalization as a proxy. However, because of the nature of cryptocurrencies, traditional methods of valuation should not be applied to the new asset class.

Comparisons are frequently made between the market cap of Bitcoin and money transmitters including Western Union, PayPal [eBay] and Moneygram, along with other companies with the same relative "capitalization." However, these comparisons are flawed for several reasons. You cannot accurately compare the market capitalization of Bitcoin against that of a company.

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[1] G. Luria, A. Turner, (2013). Bitcoin: Intrinsic Value as Conduit for Disruptive Payment Network Technology

[2] D. Woo, I. Gordon, V. Iaralov, (2013). Bitcoin: A First Assessment

**Valuing Securities**

a) **Intrinsic Value**
Intrinsic value is commonly measured using the discounted cash flow method. This is the idea that you can value a security today by discounting the future cash flows to present value. In the case of Paypal or Western Union, the firms generate revenue by charging for money transmitting services, which are then used to pay off expenses and ultimately generate a cash flow for the investors. In the case of cryptocurrencies using a proof-of-work algorithm, there are no cash flows, nor dividends paid out to holders.



Image from Heavy.com

b) **Comparable Analysis**
The idea behind comparable analysis is that you can estimate the value of a security by examining like-products in the same space. In the case of Bitcoin, this method is frequently misused by comparing Bitcoin to commodities such as gold or silver. While this is more relevant than a comparison to a company, Bitcoin, unlike gold, has transactional value. This means that the primary value drivers differ between the two. Bitcoin, within the current ecosystem, has no "comparable cryptocurrencies," as most value within alternative cryptocurrencies is driven purely by speculative trading with minimal utilization for payments.

One thing many evangelists focus on is the potential for a cryptocurrency to take over as sovereign currencies, particularly within distressed regions in Europe and Latin America. Some strides have even been attempted to develop a sovereign cryptocurrency with the release of Auroracoin for Iceland, Mazacoin for the Lakota Indian Tribe, among others. However, you cannot translate an M2 into cryptocurrency value by simply dividing by the number of outstanding coins.



| Scenario | Potential value of one bitcoin |
|---|---|
| Hedge funds allocate 1% to Bitcoin[2] | $ 1,230 |
| Argentines sell USD cash for Bitcoin[3] | $ 2,480 |
| Gold holders divest 1% into Bitcoin[4] | $ 3,500 |
| Bitcoin replaces remittance market[5] | $ 6,860 |
| Becomes global E-Commerce currency[6] | $ 11,500 |
| 25% of black market transactions in Bitcoin[7] | $ 44,000 |
| Bitcoin replaces reserve currency[8] | $ 500,000 |
| Bitcoin replaces offshore deposits[9] | $ 800,000 |

Image from yBitcoin Spring 2014

In the same way you cannot compare a company's value to that of Bitcoin's, you cannot use transaction volumes as a proxy. It creates an oversimplification for demand, which this paper will discuss further. This is, however, an important data point that can be taken as a factor in

combination with other variables including the velocity of Bitcoin, or the average number of times each BTC is spent in a year.

As you start to note the core differences between where value is derived in a company, commodity, or currency, whether it be physical assets, cash flows, store of value or utilization, it becomes apparent that you are comparing two completely different asset classes. Using existing products as a reference point to valuing an entirely new asset class is comparing apples and oranges.

**Value Drivers**

The first step to valuing a product is to identify the value drivers. For a company, it can be cash flows that you can discount, assets that you can sell off in liquidation, or potential synergy if you were looking to acquire a company. In order to identify the value of an individual bitcoin, I propose identifying cryptocurrency as a good and using demand and supply as value drivers, with demand being the required value to maintain current levels of transaction volume and supply being the coins circulated to facilitate those transactions, or Active Coins.

$$1 \, BTC = \frac{Required \, Market \, Capitalization}{Active \, Coins}$$

**Demand**

The demand value is driven by Bitcoin's utilization as a payment network or currency. At any given point, there is a required capitalization to maintain a certain level of transaction activity. This would include transactions that are considered payments, such as purchases and remittances, but would exclude speculative FX transactions on exchanges as these do not add value to Bitcoin's use as a payment network.

The idea behind the formula below is based off of the quantity theory of money:

$$M * V = Total \, Expenditure$$

With V being the velocity of Bitcoin and M being the market capitalization variable we are trying to identify, we are led to:

$$Required \, Market \, Capitalization = \frac{Total \, Expenditure}{Velocity \, of \, Bitcoin}$$

Velocity represents the number of times each individual bitcoin is spent in a year. If this number increases, the use of each individual bitcoin increases, ultimately decreasing the value of each bitcoin. This is because you need less bitcoins, which now travel faster between transactions, to maintain the same level of transaction activity.

However, the required market capitalization here is different than simply multiplying price per coin by coins outstanding. Because not all coins are involved in the maintenance of the required market capitalization, calculations are always overstated.

**Supply**

Supply within cryptocurrencies is traditionally viewed simply as the current outstanding coins. This, however, does not take into fact coins that have been lost over time, coin that are withheld in distribution

and those that are not being used for transactions, namely coins being used as a store of value. In 2013, researchers have estimated that up to 64% of bitcoins remained unspent.[3] In addition to potentially lost coins, many individuals have begun using bitcoin as a long term store of value, effectively taking them out of circulation for use in transactions.

Among cryptocurrencies such as Ripple and Auroracoin, the distribution model creates an overestimation of true market cap, that which is required to maintain transaction activity. Under these models, a significant portion of cryptocurrency is withheld for future distribution, but is still factored into the regular formula of:

$$Price\ per\ Coin * Outstanding\ Coins = Market\ Capitalization$$

Taking a closer look at Ripple ("XRP"), you will see that at inception, a maximum of 100 billion XRP was created, with 20 billion retained by founders and investors, 25 billion retained by the company, and 55 billion scheduled to be released over time. As of April 11, 2014, approximately 7.58 billion XRP have been distributed with over 72.4 billion currently held by the company.[4] By introducing additional XRP into distribution, the value of each individual XRP will be diluted as there will be more XRP available to be used within the payment network.

Auroracoin ("AUR") suffered a similar problem, where 50% of the overall AUR was to be distributed to citizens of Iceland. This meant that if 1% was mined shortly after release, the representative market caps factored in 98% of coins that were not in circulation. This led AUR to grow past the market capitalization of Litecoin ("LTC") and ultimately led to mass media coverage from reputable news sites such as IBTimes[5] to cryptocurrency focused sites such as Coindesk.[6] Ultimately, the initial release of the unused coins in Iceland led to a decline in the price of each AUR by over 45%, versus bitcoin which remained stable over the same period, demonstrating the dilutive effect.

One frequently cited use case for Bitcoin is its potential as a store of value, especially in countries such as Venezuela and Argentina, where the inflation rate was estimated at 56.2% and 20.8% for 2013.[7] As Bitcoin adoption begins to grow, daily interactions with bitcoin will naturally begin to increase. The effect on demand will change with increased use of the payments network, while the effect on supply will change with increased use of bitcoin-denominated savings and investments.

Looking to other examples of changing supply, Second Market's Bitcoin Investment Trust is an example of a use case that would decrease the number of Active Coins. As they increase their holdings, the number of bitcoins in circulation for transactional use decreases. The same applies for hedge funds and institutional holders. Long-term, as institutional interest increases and funds begin to purchase bitcoins for investment vehicles, intrinsic value will naturally increase due to a decreased Active Coin count. Seized bitcoins, such as those in the case of the Silk Road seizure, will also have a similar impact on Active Coins. However, if seized coins are primarily used as savings when they are seized, there will be no effect on the intrinsic value. Likewise, sales from one institution to another will have no wide-scale effect on intrinsic value. It is only when these holdings are sold to the public that the Active coin count will increase, decreasing intrinsic value by virtue of dilution.

Lastly, increases in lost bitcoins will always increase the intrinsic value as they are permanently taken out of circulation for use in transactions. This includes lost private keys and any use of proof-of-burn systems,

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[3] S. Meijlejohn et al., (2013). A Fistful of Bitcoins: Characterizing Payments Among Men with No Names. 3-4

[4] https://www.ripplelabs.com/xrp-distribution/

[5] http://www.ibtimes.co.uk/what-auroracoin-icelandic-cryptocurrency-passes-litecoin-1-billion-valuation-1438833

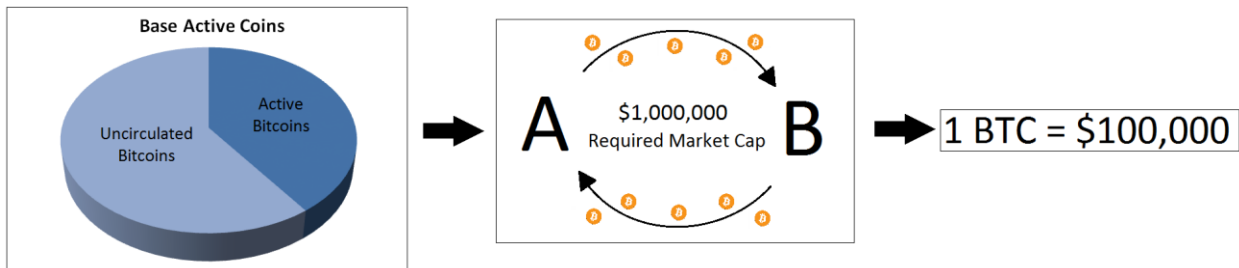[6] http://www.coindesk.com/icelands-auroracoin-passes-litecoin-becomes-third-largest-altcoin-market-cap/

[7] CIA World Factbook

where bitcoins are sent to a public address without a known private key. Such was the case with Counterparty, a cryptocurrency funded with 2130 BTC sent to an address where bitcoins are unrecoverable and thus, removed from the Active Coin count.
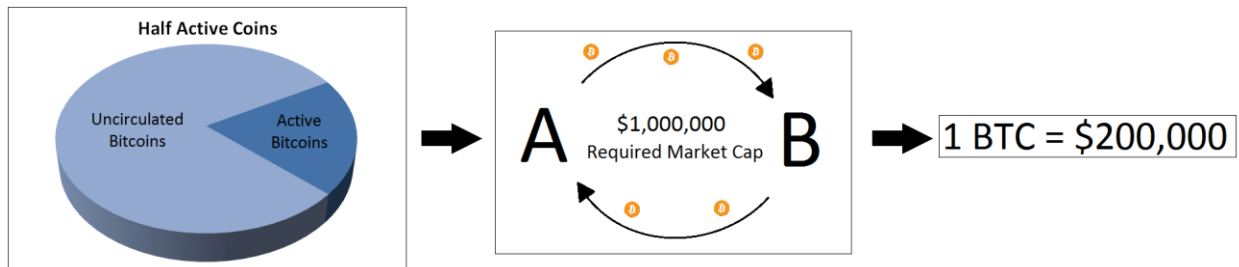
**Supply Example**

Assuming a constant Required Market Capitalization, increasing or decreasing the number of Active Coins will dilute the value each individual coin as illustrated below:
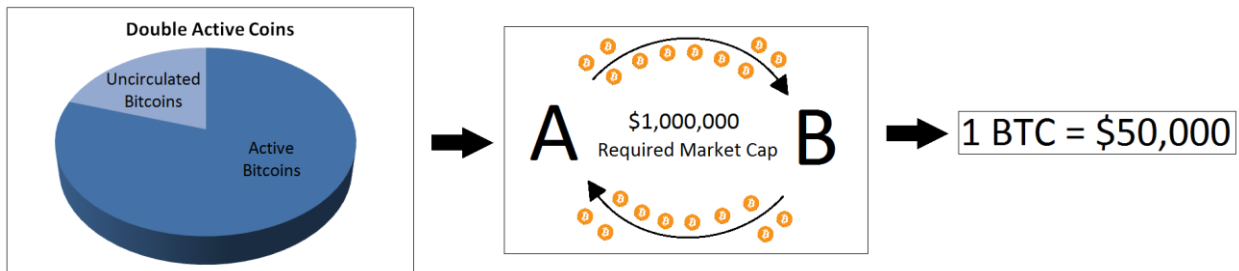
Assuming that 10 BTC are Active Coins, with a Required Market Cap of $1 million, each BTC should be worth $100,000.



If you then purchase 5 BTC and put it in your long-term savings, there will be 5 BTC remaining active to propagate the network and maintain transaction activity, leading to an intrinsic value of $200,000 per BTC.



If then, a large institution decides to sell its holdings of 15 BTC into the market, the number of Active Coins will then increase four-fold. The value of each coin will adjust accordingly to $50,000.



One method of calculating Active Coins is by creating assumptions based on coin age. For example, you can assume that coins that have not changed addresses in the past two years are either lost or are being used as a long-term store of value. These "inactive coins" should be removed from the current total supply of coins to reach your Active Coins. A sensitivity analysis can also be conducted with different ages to identify the current number of inactive coins.

However, calculating an exact number of Active Coins is difficult because of the nature of the original Bitcoin protocol, where companies such as Coinbase hold custody of the bitcoins and have off blockchain transactions between accounts. While transaction may occur, they would not appear on the blockchain. Consequently, this would mean that a single wallet can have inactive coins that are still being used for transactions and would otherwise be considered active. Additionally, wallet management techniques can move cryptocurrency across wallets numerous times each day, and would further obfuscate the true number of Active Coins.

Longer-term, the blockchain can be parsed to figure out which wallets have been lost by selecting wallets with very extended periods of inactivity. Also, industry statistics can be used to estimate institutional holdings and personal savings as a percentage of outstanding coins.

**Applying the Formula**

For the purposes of calculating the potential value of 1 BTC, I created 3 cases based on daily transaction volumes for a back-of-the-envelope measure of potential growth in intrinsic value.

I assume a 5-year horizon, putting the total mined BTC at 17 million. Velocity is on an annual basis. I used institutional ownership and long-term savings as a proxy for inactive coins and applied the following formula:

$$1 \, BTC = \frac{Total \; Expenditure}{Velocity * Active \; Coins}$$

**Current Value**

I used the current daily transaction volume as of April 11, 2014 of $60 million from Coinometrics to create a sensitivity analysis gauging intrinsic value, with 12.6 million BTC outstanding. Since institutional ownership is not a major driver yet, you can base your assumptions on the coins that have been lost and in savings thus far. The current price as of April 11, 2014 is $430 USD/BTC. Daily transaction volumes are annualized.

| $60 Million/Day | | Velocity | | | | | |
|---|---|---|---|---|---|---|---|
| | | 5 | 10 | 15 | 25 | 50 | 100 |
| Lost BTC and Long-term Savings | 30% | $ 495 | $ 248 | $ 165 | $ 99 | $ 50 | $ 25 |
| | 40% | $ 578 | $ 289 | $ 193 | $ 116 | $ 58 | $ 29 |
| | 50% | $ 693 | $ 347 | $ 231 | $ 139 | $ 69 | $ 35 |
| | 60% | $ 867 | $ 433 | $ 289 | $ 173 | $ 87 | $ 43 |
| | 70% | $ 1,155 | $ 578 | $ 385 | $ 231 | $ 116 | $ 58 |
| | 80% | $ 1,733 | $ 867 | $ 578 | $ 347 | $ 173 | $ 87 |

**Base Case**

For the base case, I assumed $1 billion in daily transactions, ranking it as the 5th largest payment processing network behind Visa, MasterCard, China Unionpay and American Express. This represents a CAGR of 75% from 2014 – 2019.

| $1 Billion/Day | | Velocity | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | 5 | 10 | 15 | 25 | 50 | 100 |
| Institutional Ownership and Long-term Savings | 30% | $ 6,134 | $ 3,067 | $ 2,045 | $ 1,227 | $ 613 | $ 307 |
| | 40% | $ 7,157 | $ 3,578 | $ 2,386 | $ 1,431 | $ 716 | $ 358 |
| | 50% | $ 8,588 | $ 4,294 | $ 2,863 | $ 1,718 | $ 859 | $ 429 |
| | 60% | $ 10,735 | $ 5,368 | $ 3,578 | $ 2,147 | $ 1,074 | $ 537 |
| | 70% | $ 14,314 | $ 7,157 | $ 4,771 | $ 2,863 | $ 1,431 | $ 716 |
| | 80% | $ 21,471 | $ 10,735 | $ 7,157 | $ 4,294 | $ 2,147 | $ 1,074 |

## Bear Case

For the bear case, I assumed $500 million in daily transactions, ranking it as the 6th largest payment processing network after Discover (Pulse and Discover Networks). This represents a CAGR of 52.8% from 2014 – 2019.

| $500 Million/Day | | Velocity | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | 5 | 10 | 15 | 25 | 50 | 100 |
| Institutional Ownership and Long-term Savings | 30% | $ 3,067 | $ 1,534 | $ 1,022 | $ 613 | $ 307 | $ 153 |
| | 40% | $ 3,578 | $ 1,789 | $ 1,193 | $ 716 | $ 358 | $ 179 |
| | 50% | $ 4,294 | $ 2,147 | $ 1,431 | $ 859 | $ 429 | $ 215 |
| | 60% | $ 5,368 | $ 2,684 | $ 1,789 | $ 1,074 | $ 537 | $ 268 |
| | 70% | $ 7,157 | $ 3,578 | $ 2,386 | $ 1,431 | $ 716 | $ 358 |
| | 80% | $ 10,735 | $ 5,368 | $ 3,578 | $ 2,147 | $ 1,074 | $ 537 |

## Bull Case

For the bull case, I assumed Bitcoin to grow to become the 4th largest payment processor with $5 billion in daily transaction volumes. This represents a CAGR of 142% from 2014 – 2019.

| $5 Billion/Day | | Velocity | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | 5 | 10 | 15 | 25 | 50 | 100 |
| Institutional Ownership and Long-term Savings | 30% | $ 30,672 | $ 15,336 | $ 10,224 | $ 6,134 | $ 3,067 | $ 1,534 |
| | 40% | $ 35,784 | $ 17,892 | $ 11,928 | $ 7,157 | $ 3,578 | $ 1,789 |
| | 50% | $ 42,941 | $ 21,471 | $ 14,314 | $ 8,588 | $ 4,294 | $ 2,147 |
| | 60% | $ 53,676 | $ 26,838 | $ 17,892 | $ 10,735 | $ 5,368 | $ 2,684 |
| | 70% | $ 71,569 | $ 35,784 | $ 23,856 | $ 14,314 | $ 7,157 | $ 3,578 |
| | 80% | $ 107,353 | $ 53,676 | $ 35,784 | $ 21,471 | $ 10,735 | $ 5,368 |

## Conclusion

I propose a measure for the intrinsic value of a cryptocurrency based on the market capitalization required to maintain its transaction volumes and the number of coins used within said transactions. As it stands, current views on the valuation of cryptocurrency stem from using existing methods for other asset classes that cannot be compared to cryptocurrency. This leads to misinformation within the media and within the community. By identifying the key value drivers of price within a cryptocurrency, you are able to isolate the noise and gauge intrinsic value based on its primary use as a payment network.

BTC: 1PjYD5PekPAC2UxHHtnpk71v8AU6tEdDbm