



On-Chain Data

A Framework to Evaluate Bitcoin

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Introduction	3
Investors Can Analyze Open-Source Data and Assess Bitcoin's Fundamentals	3
Why Bitcoin?	5
Layer 1: Assessing the Health of The Bitcoin Network	6
I. Monetary Integrity	6
II. Security	8
III. Usage	9
• Active Addresses	9
• Transaction Volume	11
Layer 2: Assessing Buyer and Seller Behavior	12
A Look Into Bitcoin's Inner Economics	13
UTXOs: Bitcoin's Transaction Ledger	13
Buyer-And-Seller Behavior Metrics	14
I. Cointime Destroyed	14
II. On-Chain Profits and Losses	15
III. Realized Capitalization	16
IV. Thermo Capitalization	17
V. HODL Waves	18
Layer 3: Valuing Bitcoin	19
I. Cost Basis Metrics	20
• Market-Value-to-Realized-Value Ratio	20
• Market-Value-to-Thermo-Value Ratio	21
• Investor Capitalization	22
• Short-to-Long-Term-Realized-Value Ratio	23
II. Profit and Loss Metrics	24
• Realized Profits-to-Value Ratio	24
• Short-Term-Holder Profit/Loss Ratio	25
• Seller Exhaustion Constant	26
Conclusion	26



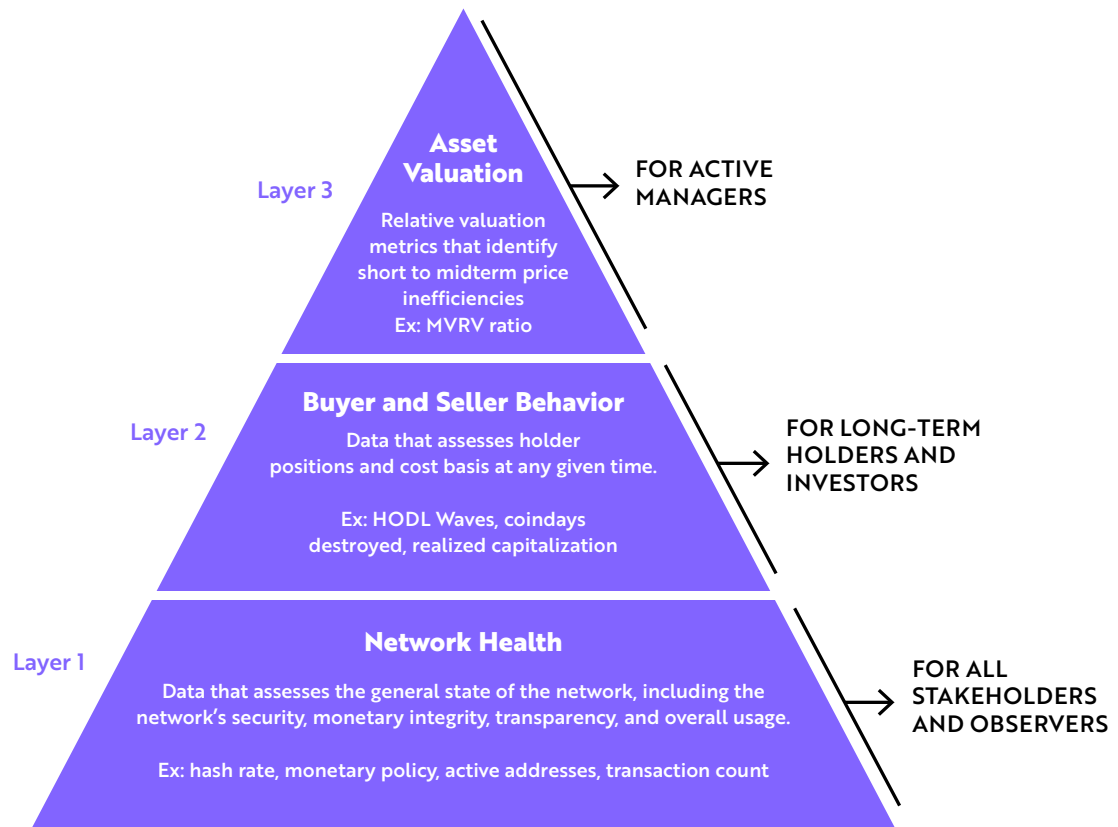
This white paper was co-authored by David Puell (@kenoshaking) using data from Glassnode. David is a full-time cryptocurrency on-chain analyst and market researcher. Glassnode is a blockchain data and intelligence provider that generates innovative on-chain metrics and tools for digital asset stakeholders.

Introduction

Bitcoin's inability to fit neatly within the framework associated with traditional asset classes has prevented many institutional investors from adopting it. Instead of considering its unique attributes, skeptical investors seem to have concluded that Bitcoin (the blockchain) and bitcoin (the cryptocurrency) cannot be analyzed fundamentally. In this white paper, we illustrate how on-chain data offers a new framework for analyzing emerging monetary assets like bitcoin. As institutional investors gain exposure to bitcoin, we believe that the network's three data layers will enhance their understanding of and confidence in its underlying fundamentals.

Investors Can Analyze Open-Source Data and Assess Bitcoin's Fundamentals

As we will explore in this white paper, we believe market participants can source on-chain data to analyze Bitcoin in more depth than is possible with any other traditional asset. We organize the analysis that is possible in a three-layered pyramid, the lower layers serving as the building blocks for higher layers, as shown on the next page.



Note: The Market Value to Realized Value (MVRV) ratio is a long-term metric used to assess bitcoin's market cycles over the long term.
HODL is a term derived from a misspelling of "hold" that refers to buy-and-hold strategies in the context of bitcoin and other cryptocurrencies.
Source: ARK Investment Management LLC, 2021

Before delving into details, the data in the bottom layer of the pyramid assesses the general health of the network: network security, monetary integrity, transparency, and usage. Accessed by any blockchain "search-engine,"¹ the data in this layer is raw and straight-forward, requiring little to no manipulation. Relevant to all market observers, it offers a basic "fact sheet" about the network.

The data in the middle layer delves deeper: by wallet address, it discloses each holder's positions and cost bases at any time of the day. In the long-term, bitcoin's price might react more to the raw health of the network as measured in layer 1, but analysis of buyer and seller behavior in the short- to medium-term can surface inefficiencies in the pricing and valuation of this non-productive asset.

Finally, the top layer of data leverages off the two lower layers, providing relative valuation metrics that identify short- to mid-term inefficiencies in bitcoin's price. Particularly useful for active managers, the top data layer provides buy and sell signals in the crypto market, much like relative valuation metrics like EV-to-EBITDA² in the public equities market.

1 BTC.com Professional Data Service for Global Blockchain Enthusiasts." BTC.com Professional Data Service for Global Blockchain Enthusiasts, <https://btc.com/>.

2 Enterprise Value over Earnings Before Interest Taxes Depreciation & Amortization



In collaboration with Glassnode,³ we illustrate how on-chain data offers a new framework in which to analyze emerging monetary assets like bitcoin. As institutional investors gain exposure to bitcoin, we believe that the network's three data layers will enhance their understanding of and confidence in its underlying fundamentals. Throughout this white paper, we aim to unpack the power of on-chain data and describe the tools and techniques that enable investors to turn raw open-source data into actionable investment decisions.

Although we will extend this framework and analysis over time to other cryptocurrencies that run on open-source software, the focus of this piece is on bitcoin and the Bitcoin network. Important to note, no other network rivals Bitcoin's in transparency which, in our view, makes it the most "analyzable" and fundamentally-sound network.

Why Bitcoin?

Not all blockchains are created equal. The more open and transparent a blockchain is, the easier market participants can analyze its underlying fundamentals. The most useful public blockchains offer easy-to-access tools to audit their networks. Today, any individual can download a Bitcoin client,⁴ install a node, and extract insightful network data with relatively low barriers to entry.

We believe Bitcoin's auditability, openness, and transparency stem from three of the network's characteristics:

1. **Simple Accounting System:** In contrast to traditional account-based accounting systems,⁵ Bitcoin's UTXO-based accounting system makes tracking supply and auditing monetary policy simple.
2. **Verifiable Code:** The implementation of Bitcoin's protocol lives in code that has been scrutinized⁶ more than any other open-source software code.
3. **Efficient Nodes:** Bitcoin nodes,⁷ or volunteer computers running software to verify the network's integrity, are much more cost-efficient than alternative cryptocurrency network nodes.

³ "On-Chain Market Intelligence." Glassnode, <https://glassnode.com/>.

⁴ "Download Bitcoin Core." Bitcoin, <https://bitcoin.org/en/download>.

⁵ Glassnode. "Introducing Account-Based on-Chain Metrics for Bitcoin and Ethereum." *Glassnode Insights - On-Chain Market Intelligence*, Glassnode Insights - On-Chain Market Intelligence, 1 May 2020, <https://insights.glassnode.com/account-based-metrics/>.

⁶ "Bitcoin Development." Bitcoin, <https://bitcoin.org/en/development#code-review>.

⁷ "Bitcoin Core." Features - Bitcoin Core, <https://bitcoin.org/en/bitcoin-core/features/>.



Layer 1: Assessing the Health of The Bitcoin Network

Investors can monitor the health of the Bitcoin network in real time by extracting raw open-source data from Bitcoin nodes. In the table below, we describe and provide metrics for three ways to assess the health of the network.

Table 1: Assessing the Health of The Bitcoin Network

Category	Description	Metrics Used for Assessment
Monetary Integrity	Participants can confirm that Bitcoin's monetary policy is acting in accordance with its programmed, deflationary schedule: a hard cap of 21 million units, with issuance that halves every four years.	- Circulating Supply - Issuance Rate
Security	Participants can track the general activity of miners securing the network.	- Hash Rate - Miner Revenue
Usage	Participants can monitor the usage and adoption of the network.	- Active Addresses - Transaction Count - Transaction Volume

Source: ARK Investment Management LLC, 2021

I. Monetary Integrity

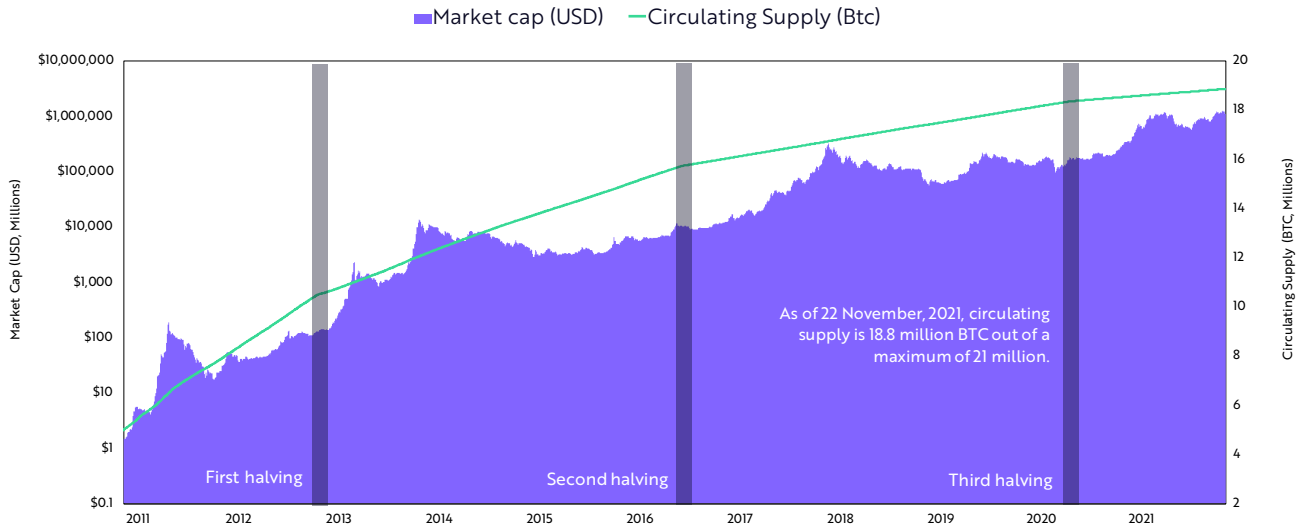
The Bitcoin protocol has ensured monetary integrity by giving analysts and investors the ability to track bitcoin's total circulating supply⁸ and daily issuance,⁹ both shown in the charts on the next page.

Total circulating supply is a function of historical monetary policy and the daily issuance associated with current monetary policy. From Bitcoin's inception, monetary policy has been pre-determined and encoded in its protocol, making it predictable and verifiable. Buttressed by a robust system of checks and balances, Bitcoin's strict adherence to a rules-based monetary policy highlights its integrity.

⁸ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.Current>.
⁹ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.Issued>.



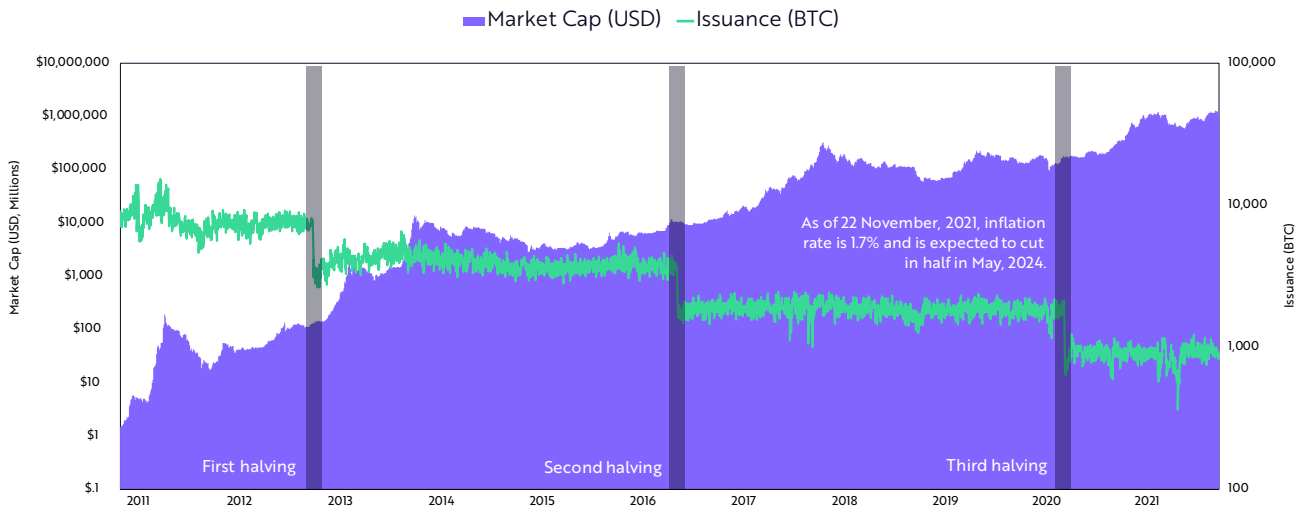
Bitcoin Circulating Supply



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Source: ARK Investment Management LLC, Glassnode, 2021

Bitcoin Issuance



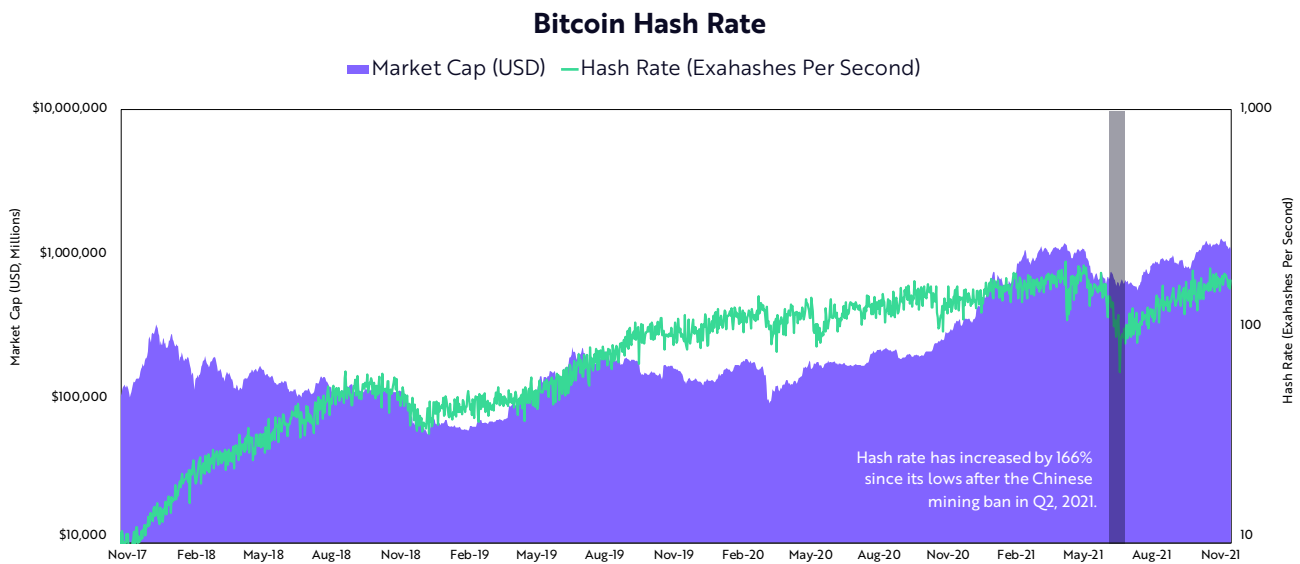
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Source: ARK Investment Management LLC, Glassnode, 2021



II. Security

Bitcoin's security is guaranteed by miners, who ensure transactions are verified and irreversible. Hash rate,¹⁰ as shown below, measures the processing power miners use to secure the network from attacks. All else equal, rising hash rate levels increase the security of the network.



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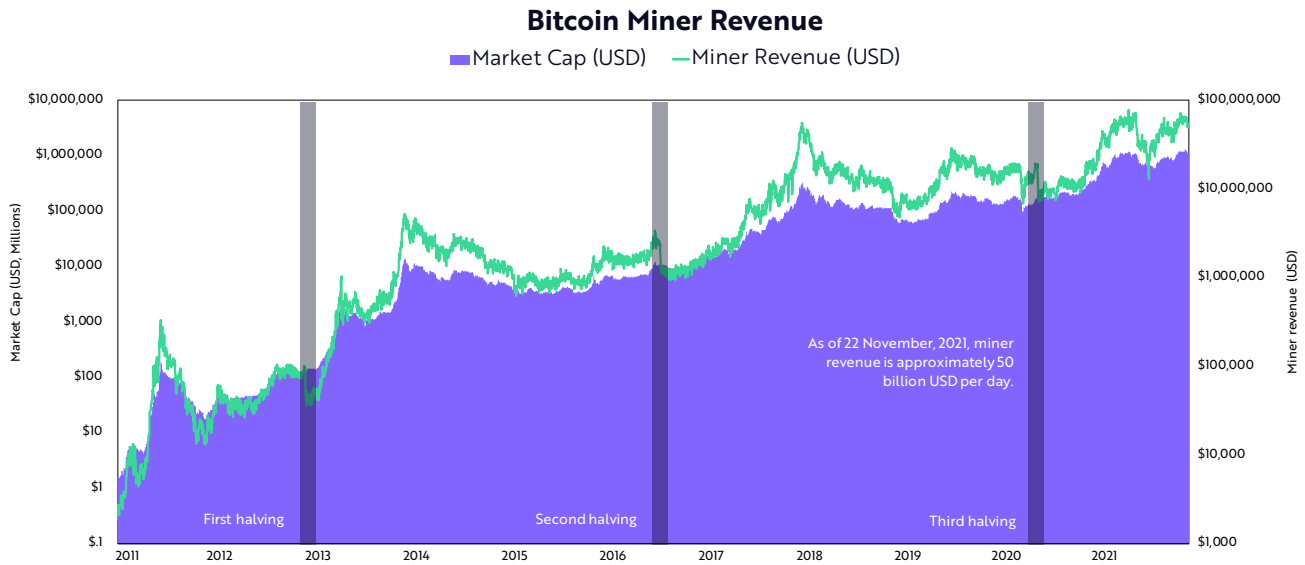
Source: ARK Investment Management LLC, Glassnode, 2021

Since the start of 2011, hash rate has increased at a rate four orders of magnitude higher than that of price. Supporting the dramatic rise in hash rate are advances in hardware and miners' willingness to invest based on the expectation of bitcoin's price appreciation over time. Even after a full ban on crypto mining in China in the second quarter of 2021, hash rate has recovered by 166% and is approaching its all-time high once again.

Miner revenue,¹¹ the sum of newly minted bitcoin and transaction fees, also is a measure of miner investment in securing the network. Since inception, miners have generated revenue of more than 18.8 million bitcoin worth roughly 1 trillion USD at current prices, as shown on the next page.

¹⁰ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=mining.HashRateMean>.

¹¹ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=mining.RevenueSum>.



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Source: ARK Investment Management LLC, Glassnode, 2021

III. Usage

Investors can monitor Bitcoin's network activity and usage by tracking the number of active addresses, a proxy for user adoption, in addition to transaction volume, a proxy for economic activity.

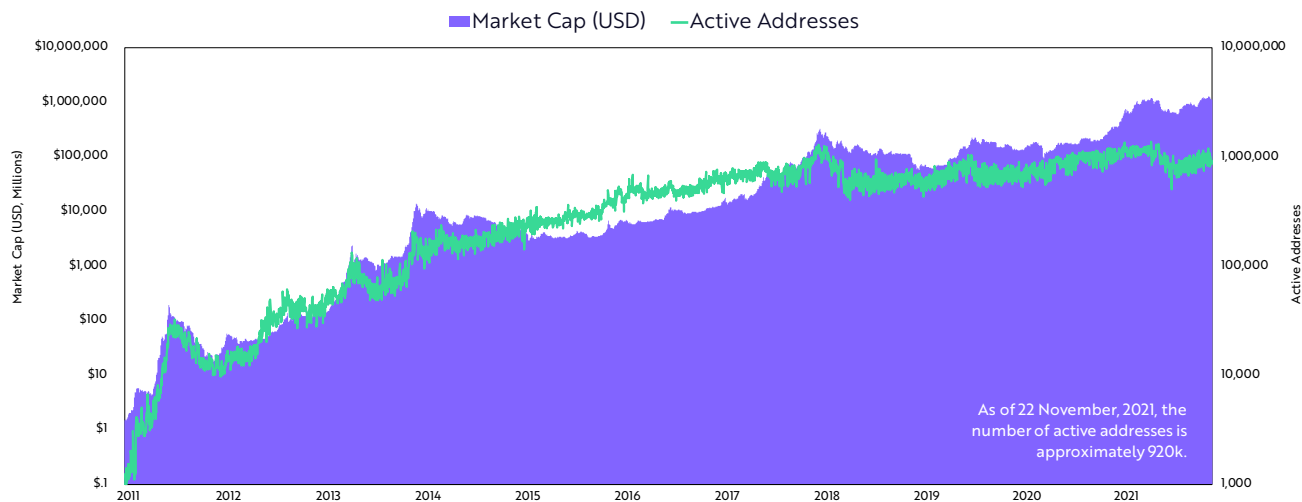
Active Addresses

Thanks to the transparency of the Bitcoin network, market participants can monitor its activity down to the level of active addresses.¹² While not a direct proxy for the number of users, active addresses show the number of unique addresses active on the network on any given day. Single addresses can represent either individuals or exchanges and mining operations. Today, the number of daily active Bitcoin addresses is roughly 920,000, its life-to-date increase correlating positively with bitcoin's price over time, as shown in the following chart.

¹² Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=addresses.ActiveCount>.



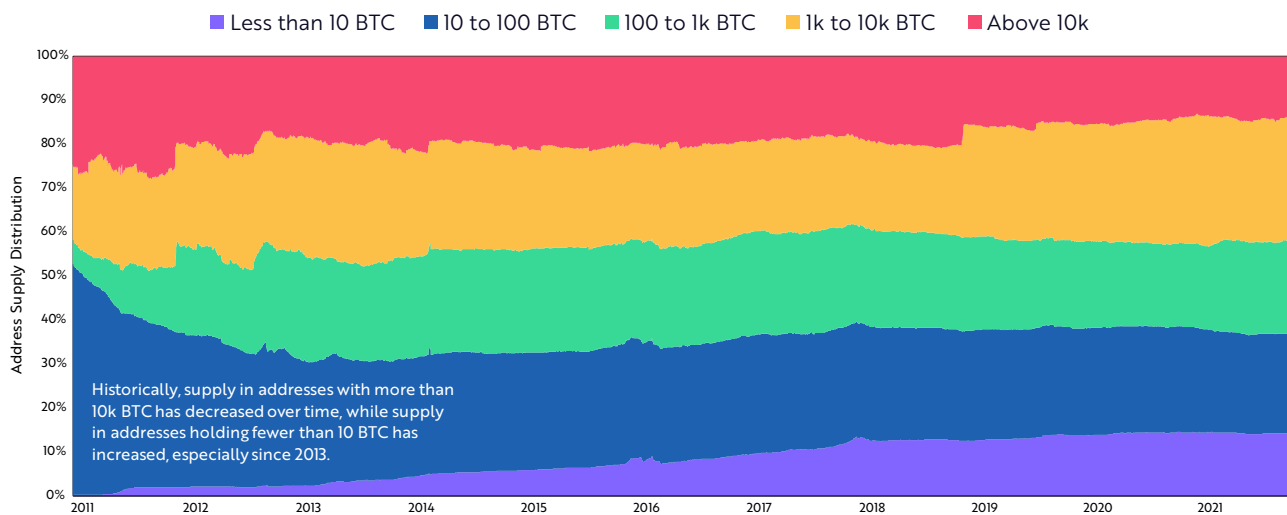
Bitcoin Active Addresses



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 Source: ARK Investment Management LLC, Glassnode, 2021

A more granular breakdown of active addresses can capture the distribution of bitcoins in each address cohort¹³ over time. As shown below, the share of bitcoin in addresses holding more than 10,000 bitcoin has decreased, while the share holding fewer than 10 has increased. In other words, it appears the wealth associated with bitcoin is decentralizing, broadening out.

Bitcoin Addresses Supply Distribution



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 Source: ARK Investment Management LLC, Glassnode, 2021

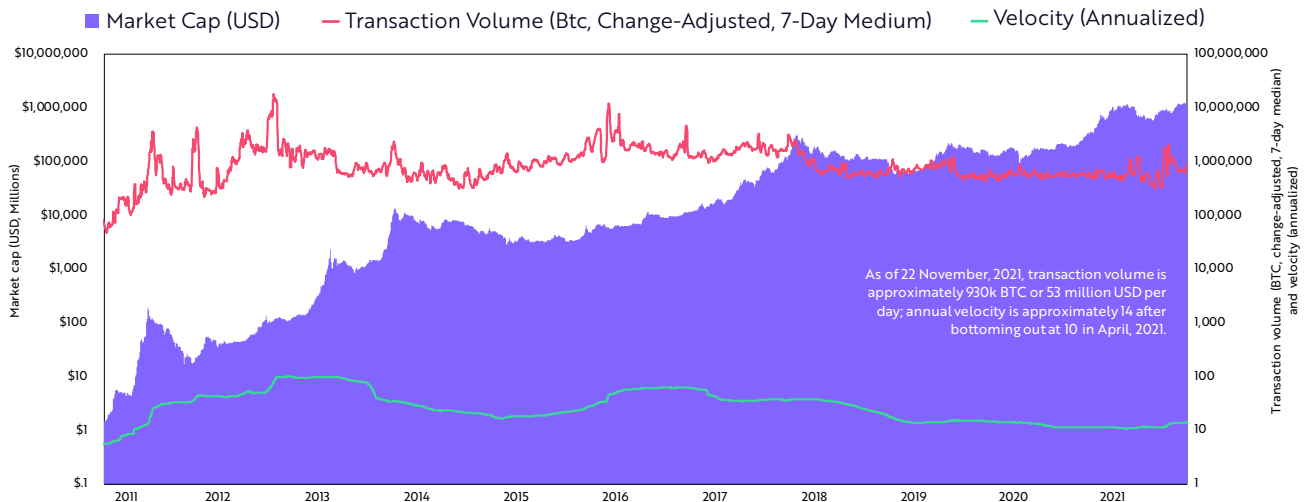
¹³ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=addresses.SupplyDistributionRelative>.



Transaction Volume

Since its creation, Bitcoin has settled approximately 21 trillion USD in transactions, highlighting its ability to serve as a global settlement system. When divided by circulating supply, transaction volume¹⁴ can provide some insights into bitcoin’s annualized velocity,¹⁵ as shown below. During April of 2021, the velocity of bitcoin dropped to 10, a level not seen since 2011, for several possible reasons: investors could be hoarding bitcoin, they could have lost their bitcoin, and/or transaction activity could be moving off-chain. Since April, annualized velocity has increased to 14, perhaps because investors are diversifying into other crypto assets or because transaction activity is moving back on-chain.

Bitcoin Transaction Volume and Velocity



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Source: ARK Investment Management LLC, Glassnode, 2021

Transaction count¹⁶ is a good proxy of economic activity but is not correlated highly with price necessarily in the short-term. Adjusting for intra-entity flows, Bitcoin has facilitated more than 544 million transactions in its near 13-year history. After hitting a multi-year low in July this year, as shown on the next page, transactions since then have increased by 108%.

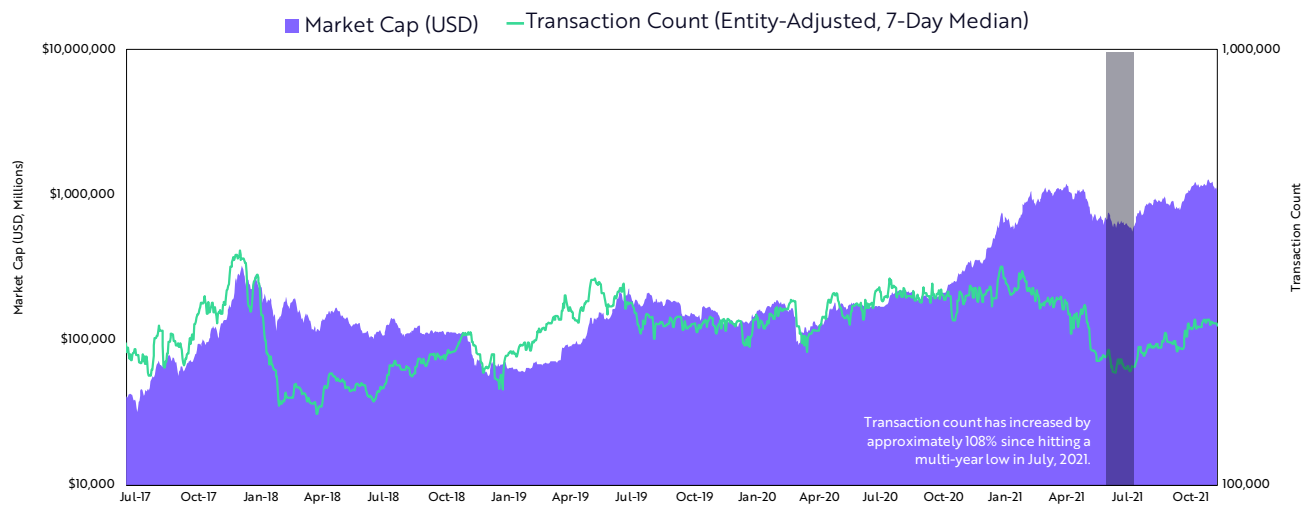
¹⁴ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=transactions.TransfersVolumeAdjustedSum>.

¹⁵ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=indicators.Velocity>.

¹⁶ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=transactions.Count>.



Bitcoin Transaction Count



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Source: ARK Investment Management LLC, Glassnode, 2021

Now that we have described the health of the Bitcoin network, we will analyze the second data layer of the pyramid, including flows into and out of bitcoin, the behavior of holders, and the cost bases of various cohorts.

Layer 2: Assessing Buyer and Seller Behavior

In this section, we will focus on the data in the middle layer, assessing bitcoin holders' positions and cost bases at any point in time.

The value of a monetary asset like bitcoin is a function of demand relative to supply. While the supply of bitcoin is mathematically metered, its demand is a function of the monetary characteristics enabling it to play the unique role of a global digital money. Since its inception nearly 13 years ago, the demand for bitcoin has trended upwards but, over shorter time periods, it has fluctuated dramatically. Based on on-chain data, investors can assess the variability of demand, and its likely impact on price, by analyzing the behavior of bitcoin buyers and sellers at any point in time.

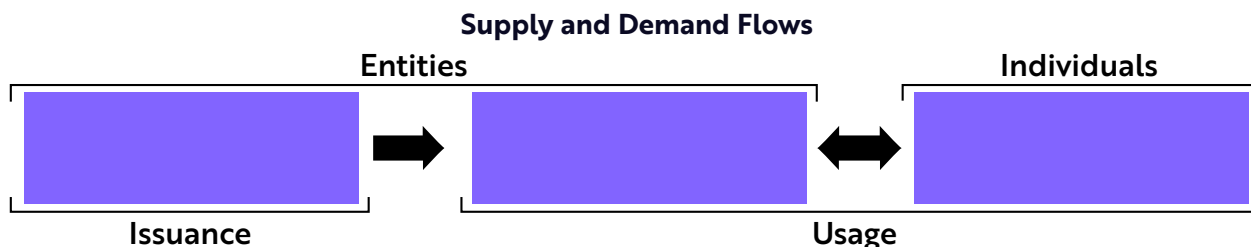


A Look Into Bitcoin's Inner Economics

Investors can leverage Bitcoin's on-chain data to assess the economic behavior—including inflows, outflows, holding patterns, and cost bases—of all market participants. It tracks each participant on-chain using simple address-based heuristics. Here we identify these participants and their roles in the Bitcoin "economy" and then depict them in the graph below.

1. **Miners and Mining Pools:** Miners are responsible for issuing new bitcoin. Funding their operations with mined bitcoin, they are the only natural sellers involved in the network. The selling pressure associated with miners is proportional to the rate of newly issued bitcoin.
2. **Exchanges:** Exchanges are responsible for bitcoin's price discovery. Passing through exchange addresses are on-chain flows from most market participants including miners, OTC desks, custodians, and holders/investors.
3. **Holders, Investors, and Users:** Holders, investors, and users round out bitcoin's economy. On-chain data measures the adoption rates and holding periods associated with financial institutions, individuals, and merchants.

Based on the economic flows and interactions between and among these market participants, we can assess bitcoin's value.



Source: ARK Investment Management LLC, 2021

UTXOs: Bitcoin's Transaction Ledger

Bitcoin's on-chain data details the behavior of participants with a simple and transparent accounting system: the unspent transaction output, or UTXO¹⁷ for short. UTXOs record the number of bitcoins in each address at the time of every transaction. If Miner Bob, for example, earns two bitcoins for validating a block of transactions and sells one of them to Investor Alice, both Bob's and Alice's UTXOs record the addition of one bitcoin after the transaction. If participants run full nodes, they can track and verify all bitcoin UTXOs.

¹⁷ Frankenfield, Jake. "What Is UTXO?" Investopedia, Investopedia, 20 Nov. 2021, <https://www.investopedia.com/terms/u/utxo.asp#:~:text=What%20is%20UTXO%3F,used%20to%20balance%20the%20ledger.>



Most importantly, UTXOs allow investors to track two data points in every address on the Bitcoin ledger: the number of coins located in each address (volume) and the amount of time the coins have been in each address (time). If the same system governed the equity markets, anyone interested could track the ownership of company shares by quantity, holding period, and purchase/sale prices.

Buyer-And-Seller Behavior Metrics

We believe the on-chain behavior of buyers and sellers helps investors identify bitcoin price inefficiencies. As described in the next section, several metrics can monitor the behavior of buyers and sellers. From these, we can derive relative valuation metrics that identify short- to mid-term inefficiencies in bitcoin's price.

I. Cointime Destroyed

First conceptualized by the pseudonym ByteCoin on the Bitcointalk.org forum in 2011.¹⁸

Cointime destroyed, widely presented as coindays destroyed,¹⁹ measures the time-weighted turnover of bitcoin: the number of bitcoins transacted within a given period (volume) and the time held before transacting (holding period). If two bitcoins had not moved in seven days but then engaged in a transaction, 14 coindays would have been destroyed. An increase in cointime destroyed implies that holders are moving coins out of long-term storage and taking profits. At approximately 4.5 billion today, coinyears destroyed,²⁰ the rolling sum of coindays destroyed during the last 365 days, depicts a healthy bull market, as shown in the next chart: bitcoin's price has hit continuous all-time highs throughout 2021, and yet coinyears destroyed still is below the all-time high hit in early 2018.

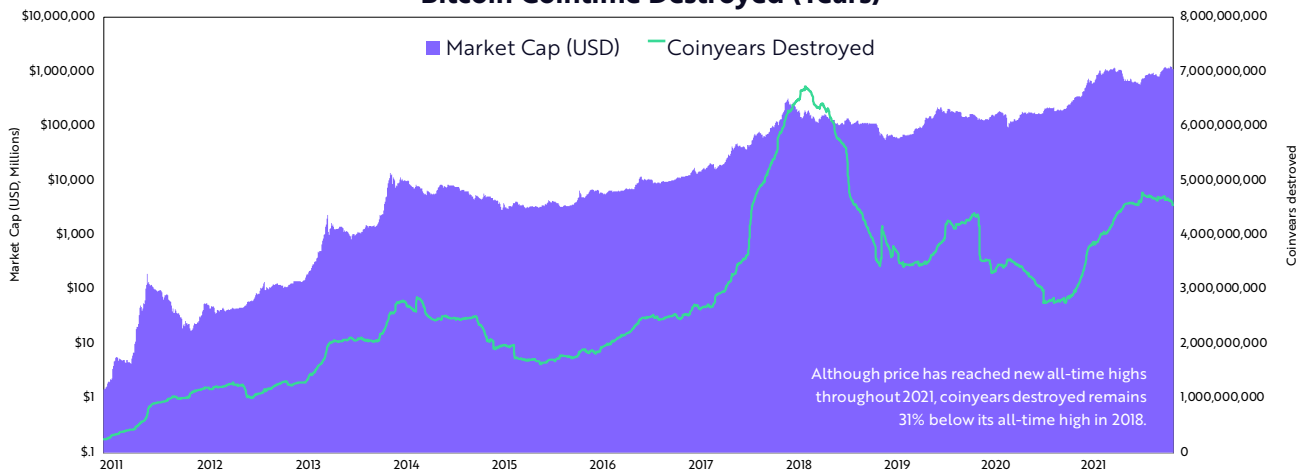
¹⁸ Bitcoin Transaction Volume, <https://bitcointalk.org/index.php?topic=6172.msg90789#msg90789>.

¹⁹ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=indicators.Cdd∓mScl=log&pScl=log&s=1348360702&u=1608681600&zoom=>.

²⁰ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&chartStyle=column∓m=indicators.CydAccountBased>.



Bitcoin Cointime Destroyed (Years)



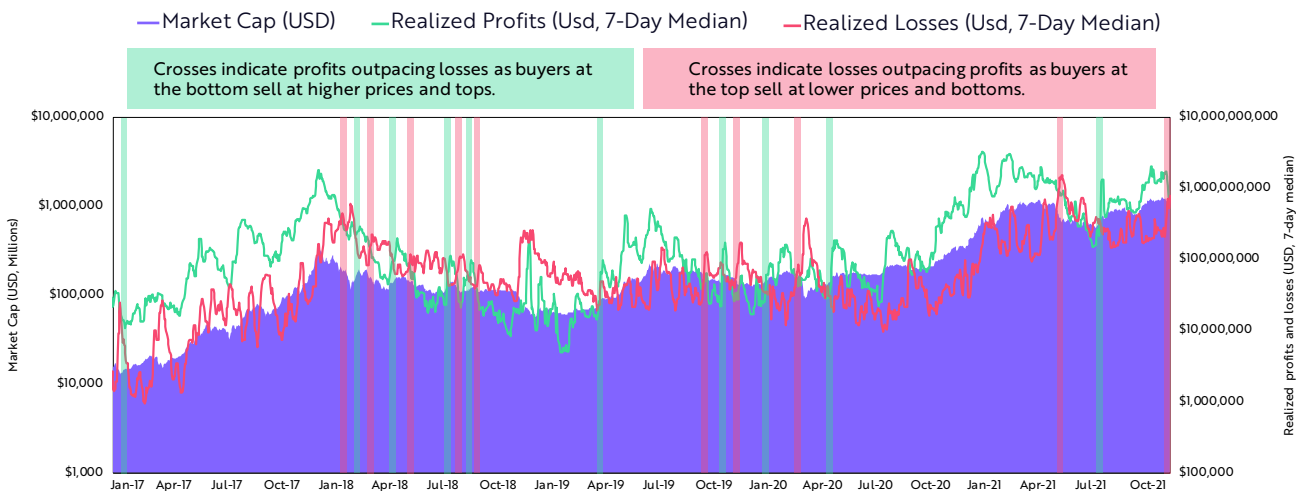
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Source: ARK Investment Management LLC, Glassnode, 2021

II. On-Chain Profits and Losses

First conceptualized by Glassnode in 2019.

Realized profits²¹/losses²² measures the total USD value of bitcoins that are transacting at a profit or a loss. If a bitcoin transacts at a higher or lower price than the price at which it last moved, its subsequent move creates a profit or a loss, respectively. Periods of extreme volatility maximize profits and losses at market tops and bottoms, respectively, as shown below.

Bitcoin Realized Profits and Losses

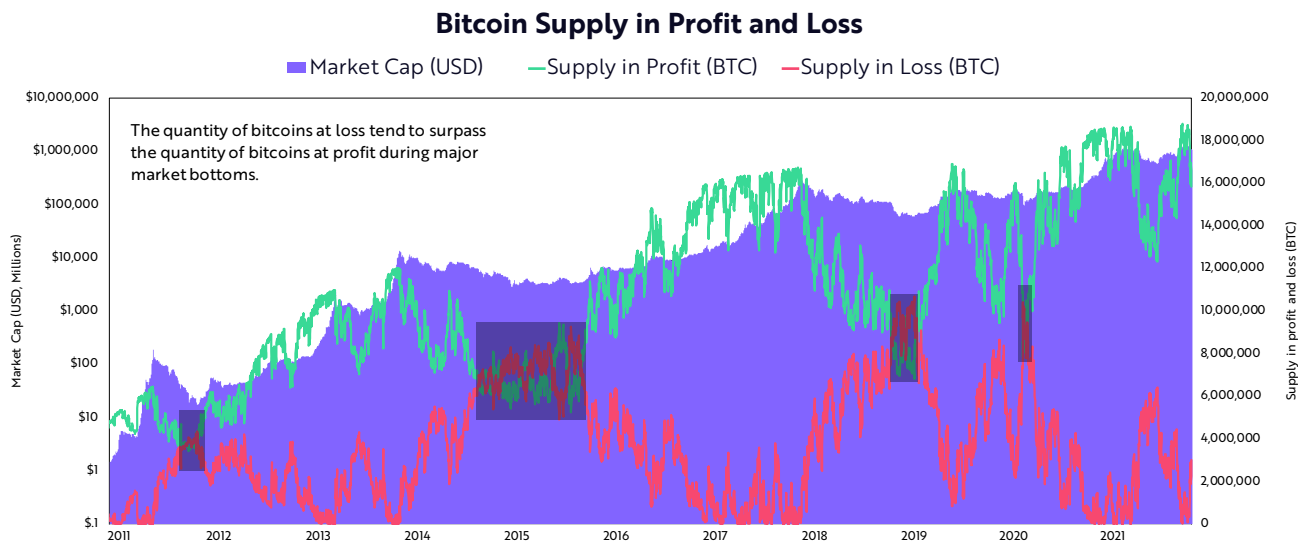


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Source: ARK Investment Management LLC, Glassnode, 2021

21 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=indicators.Realize dProfit&mScl=log&pScl=log&s=1348360702&u=1608681600&zoom=>
22 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=indicators.Realize dLoss&mScl=log&pScl=log&s=1348360702&u=1608681600&zoom=>



Supply in profit²³/loss²⁴ measures the number of outstanding bitcoins with a profit or loss relative to their last transaction. Today, the supply of "bitcoin at profit" relative to "bitcoin at loss" is 5-to-1, with approximately 15 million bitcoin in profit and 3 million at a loss. Whenever the number of bitcoins in loss has equaled or surpassed the number of bitcoins in profit, data suggests that prices have been in a cyclical bottoming process, as shown below.



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Source: ARK Investment Management LLC, Glassnode, 2021

III. Realized Capitalization

First conceptualized by Nic Carter and Antoine Le Calvez in 2018.²⁵

While market capitalization (market cap) aggregates the value of all bitcoins in circulation at current prices, realized capitalization (realized cap)²⁶ is their average cost basis, valuing each bitcoin at the price of its last movement. Whenever market cap drops below realized cap, the overall bitcoin market is selling at a loss, suggesting capitulation. Today, bitcoin's market cap is roughly \$1 trillion, more than double its roughly \$480 billion in realized cap, as shown in the next chart.

²³ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.ProfitSum&mScl=log&pScl=log&s=1348360702&u=1608681600&zoom=>.

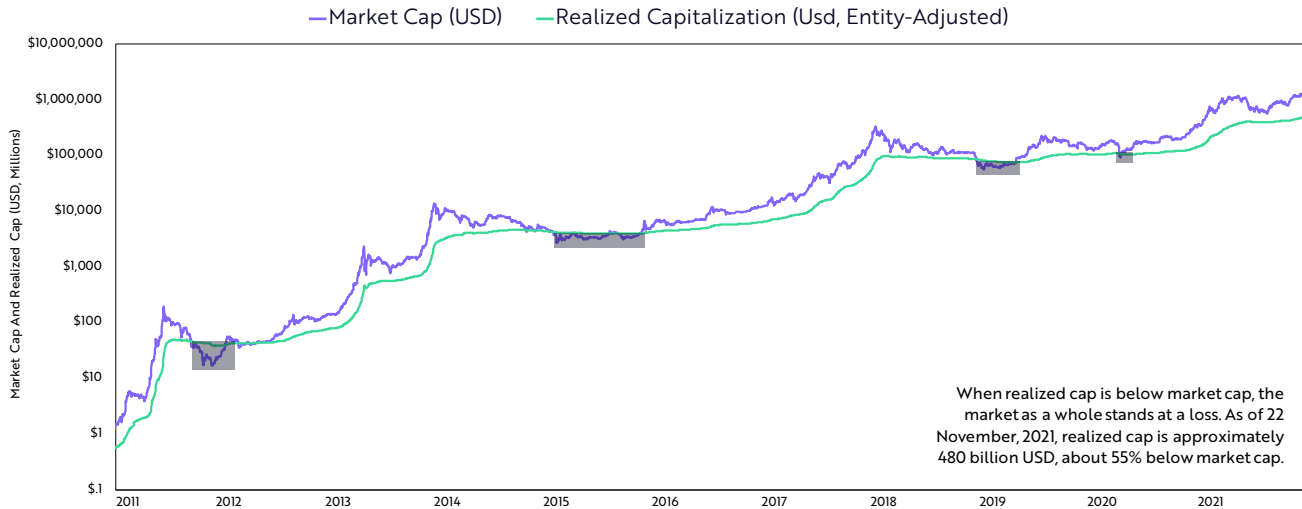
²⁴ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.LossSum∓mScl=log&pScl=log&s=1348360702&u=1608681600&zoom=>.

²⁵ "Introducing Realized Capitalization." Coin Metrics, 9 July 2021, <https://coinmetrics.io/realized-capitalization/>.

²⁶ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=market.MarketCapRealizedUsd&mScl=log&pScl=log&s=1348360702&u=1608681600&zoom=>.



Bitcoin Realized Capitalization



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Source: ARK Investment Management LLC, Glassnode, 2021

IV. Thermo Capitalization

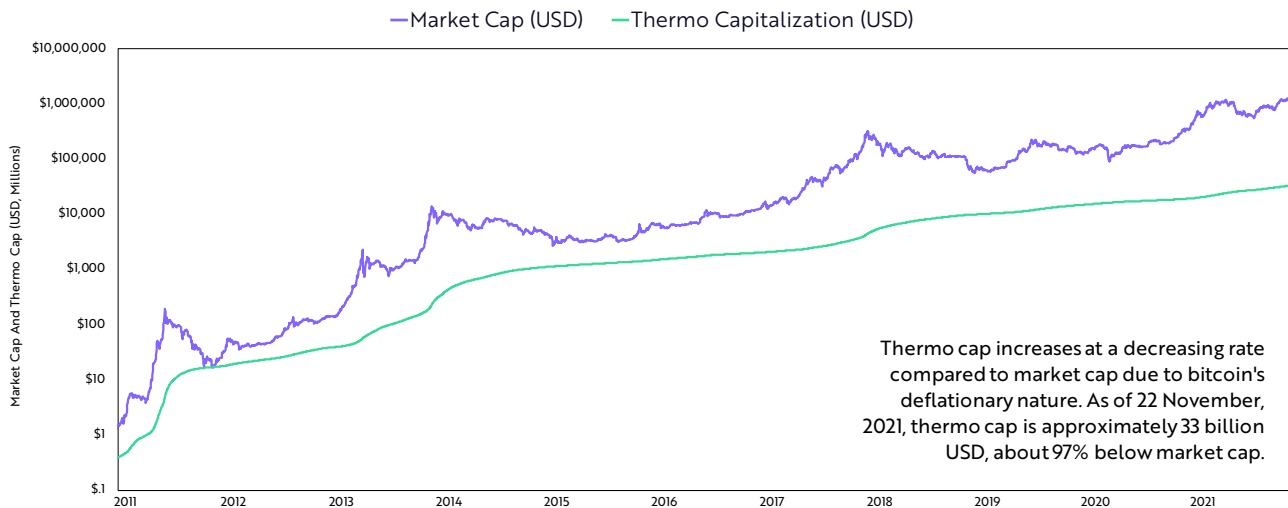
First conceptualized by Nic Carter in 2018.

Thermo capitalization²⁷ is the total USD value of coins paid to miners for validating transactions and securing the Bitcoin network. Like bitcoin's market cap during the past 12 years, thermo capitalization has increased, albeit at a decreasing rate thanks to the logarithmic increase in bitcoin's supply. Today, as shown on page 18, thermo capitalization is roughly \$33 billion, nearly 97% below bitcoin's market cap and 93% below its realized cap, illustrating that miners no longer dominate the natural sellers. Thermo capitalization, therefore, does not offer clear signals of buying and selling behavior but, as we will explore in the "M/TV Ratio" section of this article, can be an important measure of valuation.

27 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=mining.Thermocap>.



Bitcoin Thermo Capitalization



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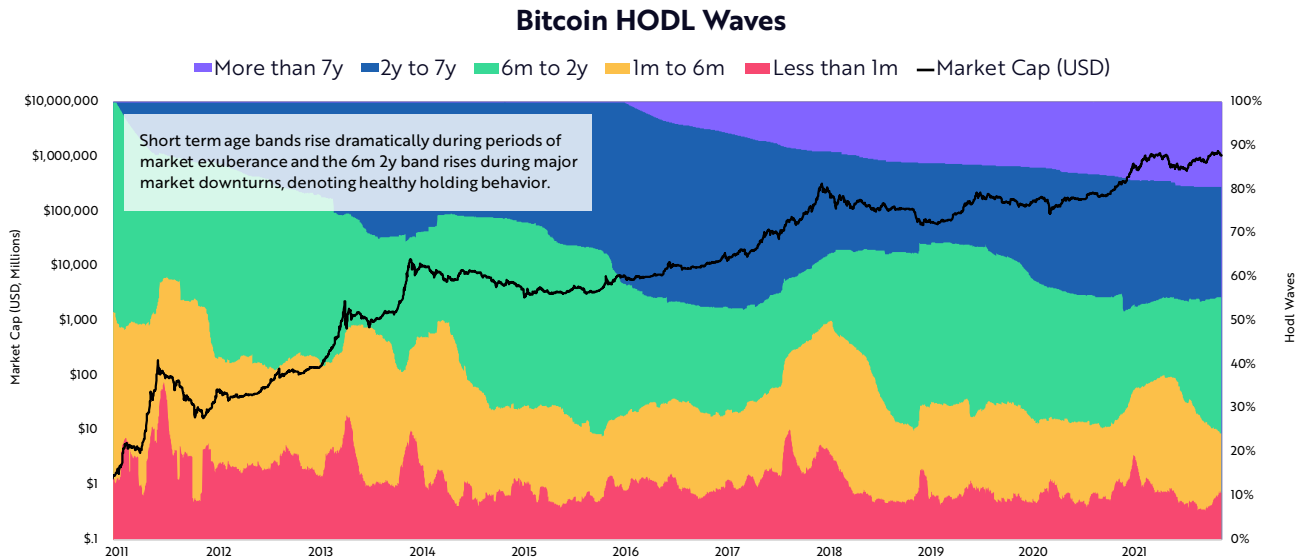
Source: ARK Investment Management LLC, Glassnode, 2021

V. HODL Waves

First conceptualized by Dhruv Bansal in 2018.

"HODL" waves,²⁸ named after the bitcoin early-adopter parody word for "hold," divides the total circulating supply of the Bitcoin network into holding period bands. The 1-week HODL wave, for example, measures the percentage of bitcoin that transacted during the last week, the 1-to-2-year HODL wave measures the percentage of bitcoin that transacted between one and two years ago, and so on. While typically it features 12 waves, the simplified chart on the following page illustrates that short-term holding period bands rise dramatically during phases of market exuberance and longer-term bands rise during major market downturns. Today, roughly 50% of bitcoin's supply hasn't moved in 2 years or more, we believe illustrating investors' longer-term conviction and focus.

²⁸ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.HodlWaves>.



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Source: ARK Investment Management LLC, Glassnode, 2021

Based on these metrics assessing the buying and selling of bitcoin, in the next section we will analyze the third data layer of the pyramid and offer relative valuation metrics which help identify inefficiencies.

Layer 3: Valuing Bitcoin

In this section, we explore the top layer of the data pyramid which offers buy and sell signals based on relative-value metrics similar to Enterprise-Value-to-EBITDA (EV-to-EBITDA) in traditional equity analysis. With this data, we believe active managers should be able to identify short- to medium-term bitcoin pricing inefficiencies.

Based on economic flows and market participant actions, two types of on-chain metrics emerge:

Cost basis metrics are a function of the costs at which different market participants transact in bitcoin over time, including:

1. Market-value-to-realized-value (MVRV) ratio
2. Market-value-to-thermo-value (MVTV) ratio
3. Investor capitalization
4. Short-to-long-term-realized-value (SLRV) ratio



Profit and loss metrics are a function of the way in which buyers and sellers hold or take profits and losses, both in USD and BTC terms, including:

1. Realized profits-to-value (RPV) ratio
2. Short-term-holder profit/loss (STH-PL) ratio
3. Seller exhaustion constant

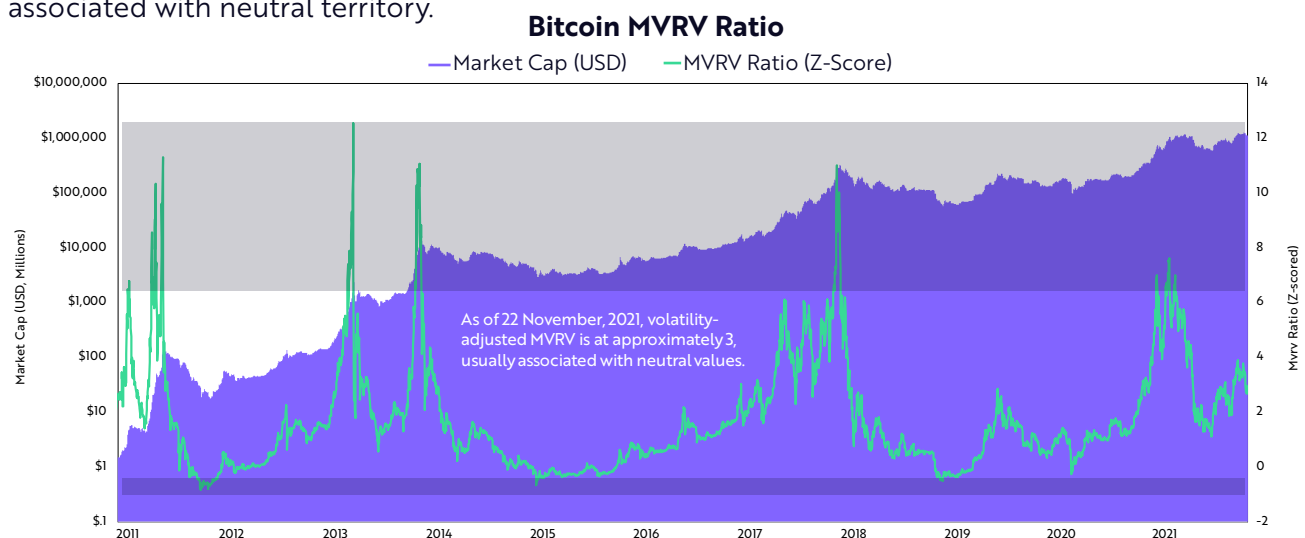
I. Cost Basis Metrics

Market-Value-to-Realized-Value Ratio

First conceptualized by Murad Mahmudov and David Puell in 2018.²⁹

The MVRV ratio³⁰ is market capitalization divided by realized capitalization,³¹ which measures the price of bitcoin relative to the average on-chain cost basis of all participants in the market. When MVRV is below 1, the market is selling at a loss, which historically has marked cyclical bottoms. Conversely, when market capitalization rises dramatically relative to average cost, bitcoin typically is poised for large-scale profit-taking.

Historically, the bitcoin price has topped out when the MVRV ratio has surpassed 10, as shown below. In early 2021, on a volatility-adjusted basis, MVRV ratio hit nearly 8, at which point the price dropped 53% in May, perhaps suggesting a local as opposed to a global top. After May's correction, MVRV went from roughly 8 to below 2. Now at nearly 3, the MVRV ratio is in a range typically associated with neutral territory.



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Source: ARK Investment Management LLC, Glassnode, 2021

29 Puell, David, et al. "Bitcoin Market-Value-to-Realized-Value (MVRV) Ratio." Medium, Medium, 28 Apr. 2020, <https://medium.com/@kenoshaking/bitcoin-market-value-to-realized-value-mvr-v-ratio-3ebc914d8bae>.

30 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=market.MvrVZScore>.

31 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=indicators.RcapAccountBased&zoom=all>.

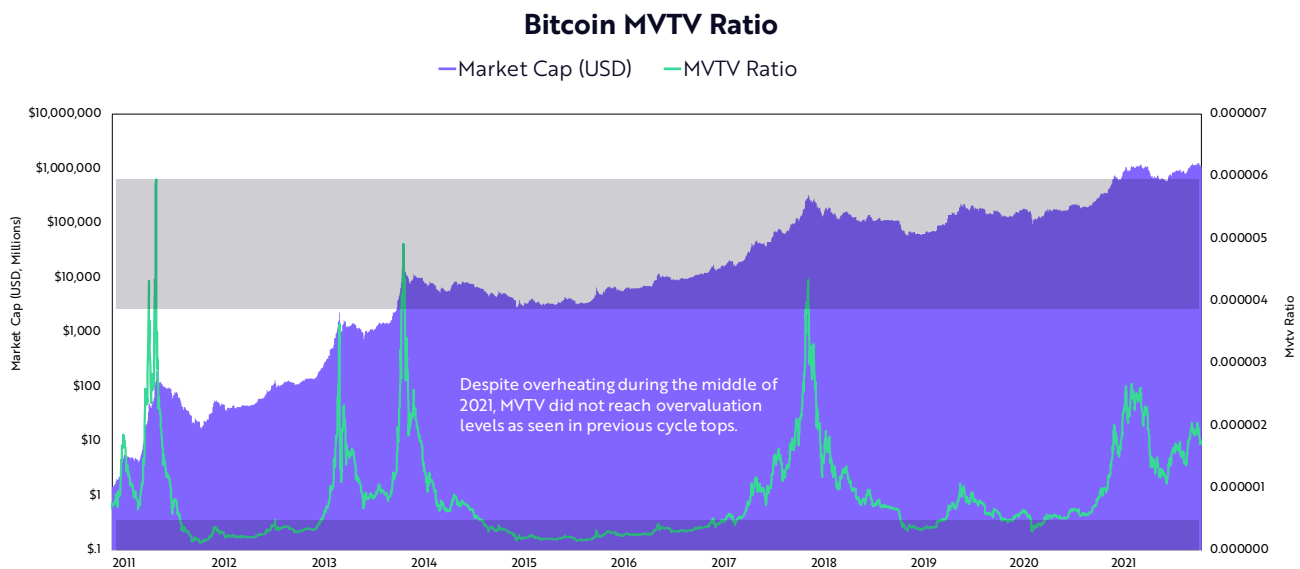


Market-Value-to-Thermo-Value Ratio

First conceptualized by Glassnode in 2019.

A mean-reversion metric, the MVTV ratio is market capitalization divided by thermo capitalization or the cumulative USD value paid to miners to secure the network.³² MVTV compares bitcoin's price to the implied value paid to bitcoin miners who, in turn, are focused on validating transactions and securing the Bitcoin network. Best explained by pseudonymous analyst GeertJancap,³³ the MVTV ratio resembles the EV-to-EBITDA multiple used in equity valuations. MVTV compares investors' current market cap to miners' cash flow.

Like MVRV, the MVTV ratio suggested last April that, at \$64,000, bitcoin was overheated but not in a cyclical blowoff top, as shown below. Since May's correction, the price of bitcoin has since recovered from its 53% drawdown to hit all-time highs once again, with MVTV also nearing its previous recent high.



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Source: ARK Investment Management LLC, Glassnode, 2021

32 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=mining.MarketcapThermocapRatio>.

33 GeertJancap. "Metric A) Miners: Think in Earnings, Interest, Tax, Debt and Amortizations. (EBITDA). Entrepreneurial World. They Decide the Same Day to Turn on/off Equipment. Currently: ~4 b\$/Yr. Metric B): Investment World (Hodlers, Savers, Speculators)=Market Cap. 'Miners Multiple' = b/a." Twitter, Twitter, 24 Sept. 2020, <https://twitter.com/Geertjancap/status/1309223044267769856>.

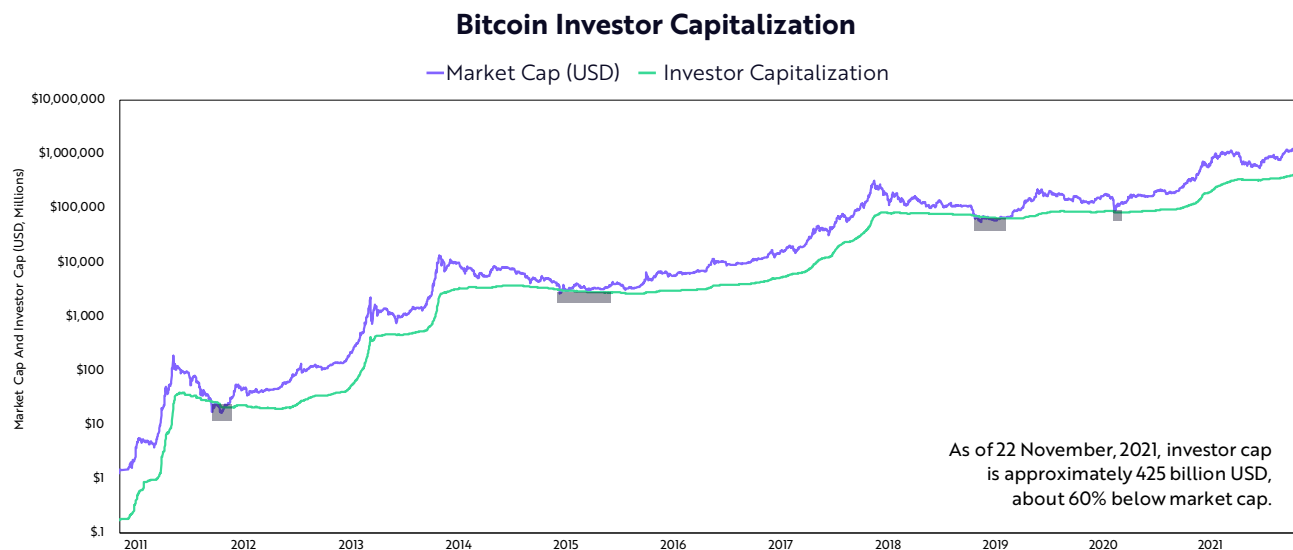


Investor Capitalization

First conceptualized by ARK Invest and David Puell in 2021.

Investor capitalization³⁴—realized capitalization minus thermo capitalization—can be a good gauge of capitulation during bear markets. Investor capitalization subtracts the thermo capitalization from the market's cost basis. By removing the outstanding value paid to miners from the overall cost basis, we can assess the fair value of bitcoin at the bottom of a market cycle.

As shown below, market capitalization tends to revert toward investor capitalization during bear markets and typically inflects when they near parity, as shown below. As of November 2021, investor capitalization is approximately \$425 billion USD, or 60% below market capitalization.



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Source: ARK Investment Management LLC, 2021

34 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=indicators.InvestorCapitalization&pScl=log>.

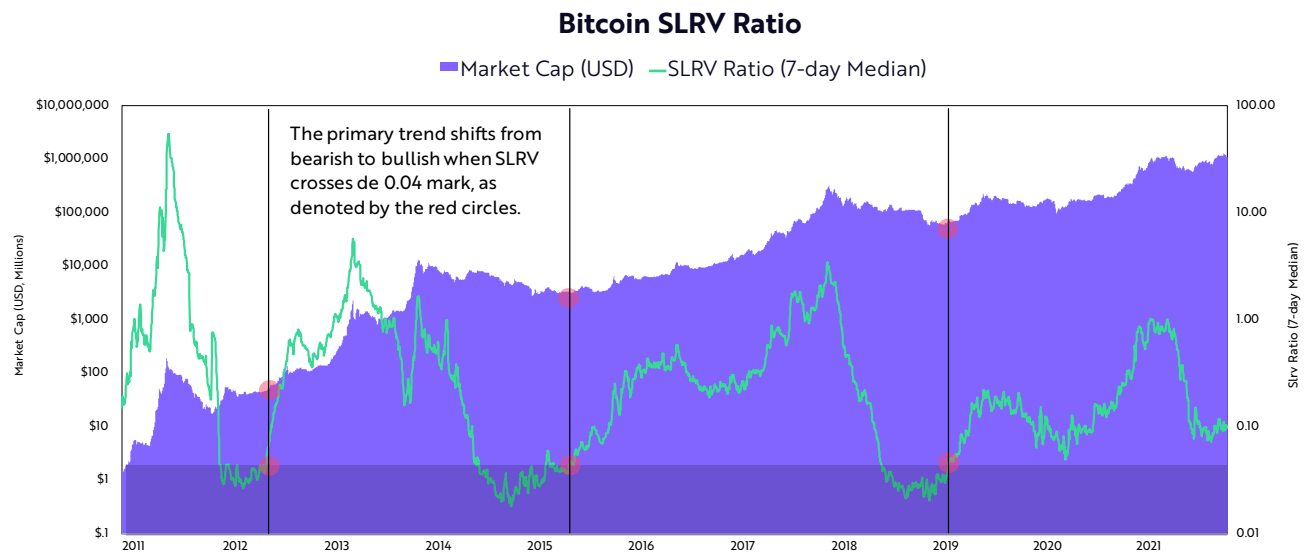


Short-to-Long-Term-Realized-Value Ratio

First conceptualized by ARK Invest and David Puell in 2021.

The SLRV ratio is the 1-day HODL wave³⁵ divided by the 6-month-to-1-year HODL wave, both weighted by realized capitalization. This metric compares the number of bitcoins moved per day to the number moved six months to one year previously or, in other words, short-term velocity relative to medium- and long-term velocity. This ratio illustrates how complex calculations can detect price inefficiencies.

Historically, a ratio below 0.04 has been associated with bear markets when short-term velocity is low, suggesting apathy relative to medium- and long-term velocity. When the ratio moves above 0.04, a new bull move tends to be underway, as shown below.



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Source: ARK Investment Management LLC, 2021

35 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.HodlWaves&zoom=all>.



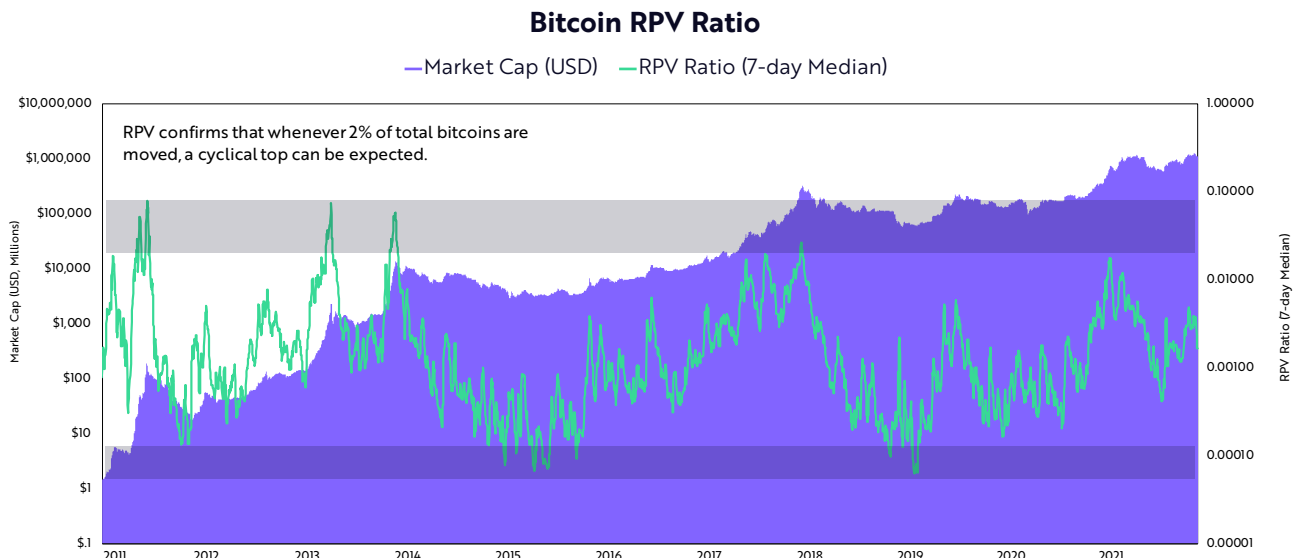
II. Profit and Loss Metrics

Realized Profits-to-Value Ratio

First conceptualized by ARK Invest and David Puell in 2021.

The RPV ratio is realized on-chain profits³⁶ in USD divided by realized capitalization, measuring the difference between daily profit-taking behavior and buyers' average cost basis. A ratio of 1—which never has occurred—would indicate that every bitcoin ever minted is moving on that particular day. Historically, when profit-takers have moved 2% or more of their holdings in one day, the market has hit a cyclical top. Conversely, when they have moved only 0.001% of their coins in one day, the market has been in the process of bottoming.

After reaching levels of exuberance slightly below .02 earlier this year, followed by the 53% drop in the bitcoin price in May, the RPV ratio has reset to much healthier, neutral levels, as shown below.



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Source: ARK Investment Management LLC, 2021

36 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=indicators.RealizedProfit&zoom=all>.

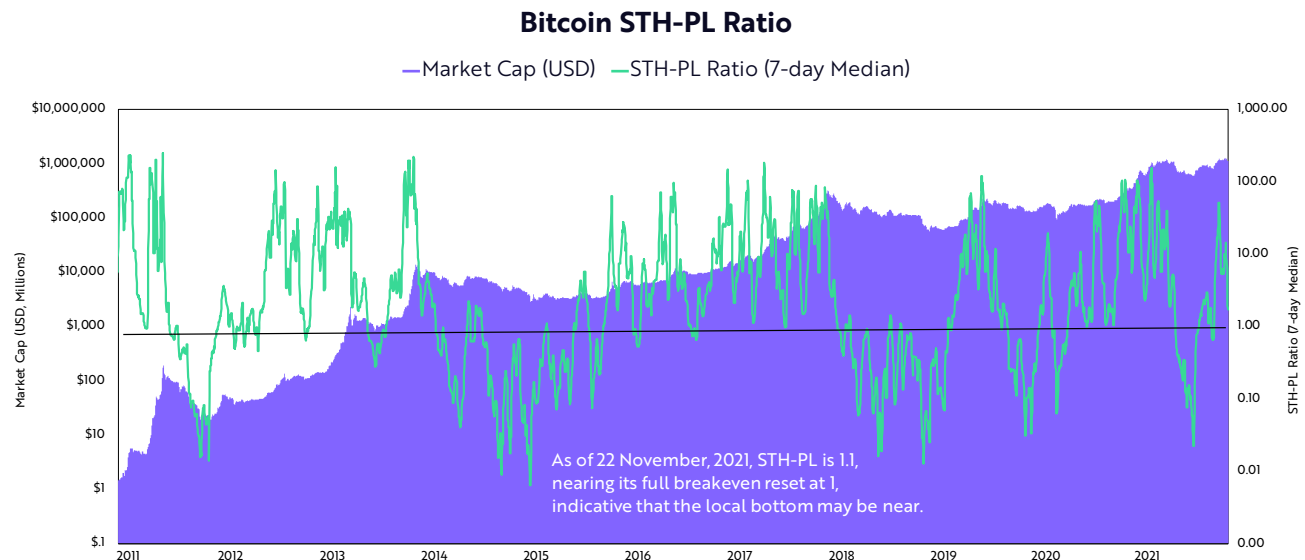


Short-Term-Holder Profit/Loss Ratio

First conceptualized by ARK Invest and David Puell in 2021.

Another measure of price inefficiencies is the short-term-holder (STH) profit/loss (PL) ratio, which is the short-term supply of bitcoin at a profit³⁷ divided by the short-term supply at a loss.³⁸ A ratio of 1 typically is associated with local bottoms in bull markets and local tops in bear markets, since short-term activity reaches breakeven equilibria. When the ratio is below 1, in the aggregate market participants who have moved coins in the last 155 days have losses. Conversely, when the ratio is above 1, short-term participants have an aggregate gain. When selling off violently below a ratio of 1, bitcoin typically has entered a bear market.

After bitcoin's 53% correction from \$64,000 USD to roughly \$28,000 this past spring, STH-PL ratio broke through 1 in September, as shown below, suggesting that price was bottoming out. Today, STH-PL stands near a reset at 1 once again, indicating another potential local bottom.



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Source: ARK Investment Management LLC, 2021

37 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.SthProfitSum>.

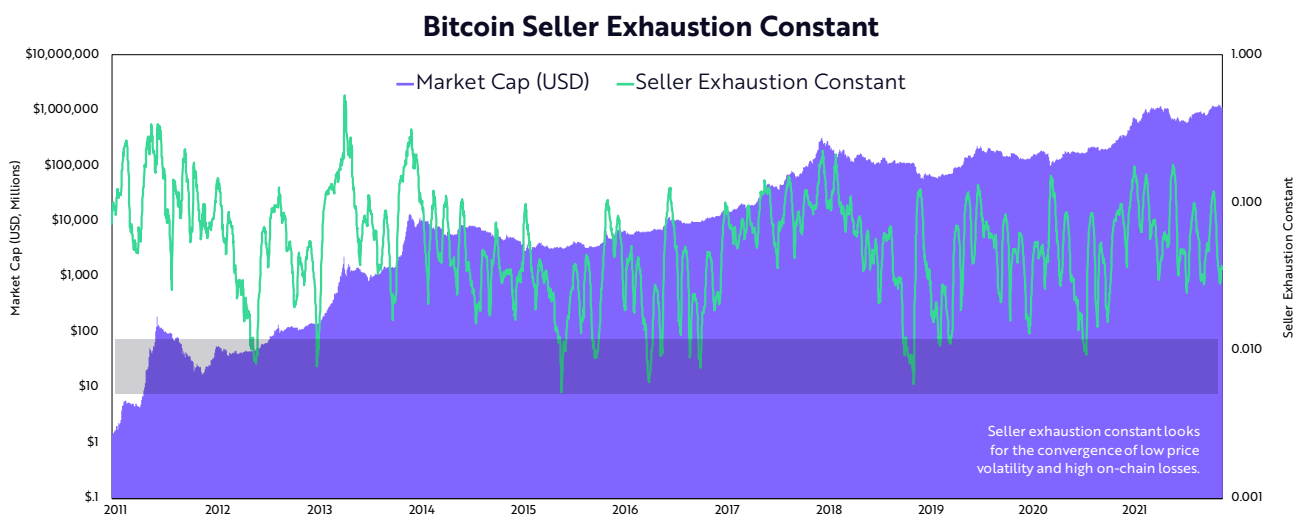
38 Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.SthLossSum>.



Seller Exhaustion Constant

First conceptualized by ARK Invest and David Puell in 2021.

Lastly, combined with profit metrics, price volatility can be an important guide to bitcoin's future price action. The seller exhaustion constant shown below is the percentage of bitcoin total circulating bitcoin supply in profit³⁹ multiplied by price volatility over the last 30 days, as shown below. This metric measures whether the two factors align. Specifically, the combination of low volatility and high losses is associated with capitulation, despondency, a bottoming out in the bitcoin price, and a lower risk environment for buying bitcoin.



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Source: ARK Investment Management LLC, 2021

Conclusion

Because bitcoin does not resemble a traditional asset, many investors seem to be grappling with ways to analyze it fundamentally. While conventional analytical frameworks are not suitable, the Bitcoin blockchain offers a unique set of tools that investors can leverage to assess its fundamentals.

In the same way that a government statistical agency publishes data about a country's population and economy, or a public company publishes quarterly financial statements disclosing growth rates and earnings, Bitcoin provides a real-time, global ledger that publishes data about the network's activity and inner economics. Without central control, Bitcoin's blockchain provides open-source data, its integrity a function of the network's transparency. In our view, investors increasingly will appreciate bitcoin's investment merits through the lens of a completely new framework: on-chain data.


³⁹ Glassnode Studio - On-Chain Market Intelligence, <https://studio.glassnode.com/metrics?a=BTC&category=&m=supply.ProfitRelative&zoom=all>.



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Yassine has been quoted on Yahoo, Yahoo Finance, Coindesk, Bitcoin Magazine, and Asia Times, among other publications. Additionally, Yassine was a featured speaker at The Fidelity Mining Summit and has been a guest on notable crypto-focused podcasts, including Marty Bent's Tales from the Crypt, Laura Shin's Unchained, Bitcoin Magazine, and Anthony Pompliano's Off The Chain.



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About Glassnode

glassnode

Glassnode is a blockchain data and intelligence provider that generates innovative on-chain metrics and tools for digital asset stakeholders.



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