Hashdex

Bitcoin's Halving

An investor's guide

Content

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The supply of bitcoin[1] is driven by three unique factors

1. Scarcity

BTC's supply is capped at 21 million, verified by participants running full nodes (i.e., the network of computers hosting Bitcoin).
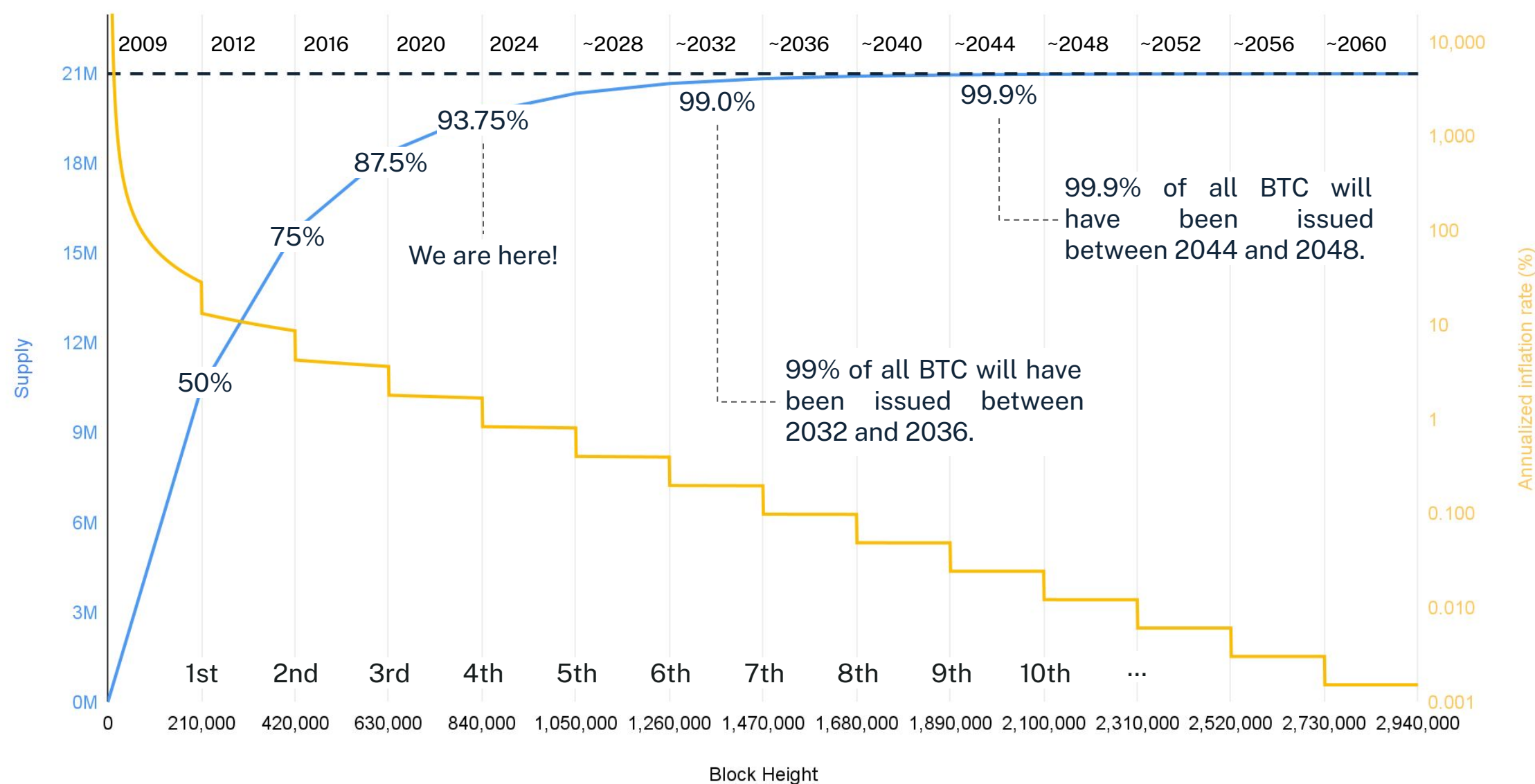
2. Disinflation

The rate of expansion (inflation) of the BTC supply diminishes over time in regular intervals with predetermined subsidies to miners.

3. Consistency

Halvings cut the inflation rate of BTC and ensure that BTC's supply cap will be reached in transparent and regular intervals over time.
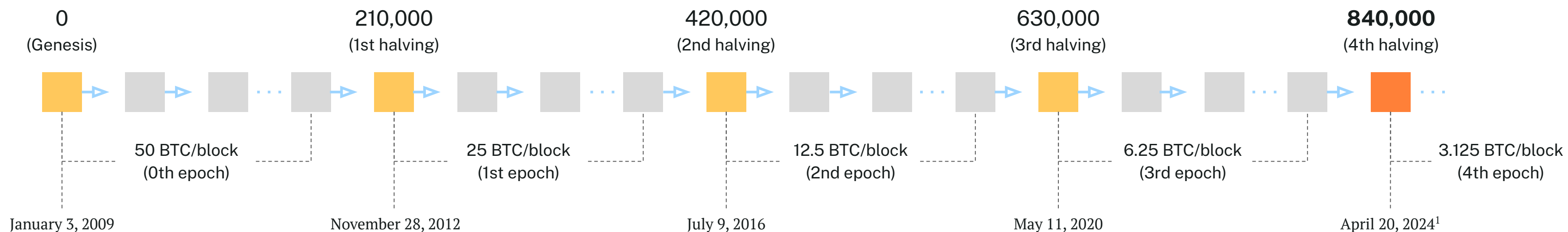
Bitcoin's supply and annualized inflation rate[2]

1 "Bitcoin" with uppercase "B" refers to the network, whereas "bitcoin" with lowercase "b" or "BTC" refers to the asset.
2 Hashdex Research according to the theoretical supply schedule of Bitcoin since inception. Past halving years according to the dates of previous events, and projected future dates assuming average block times of 10 minutes until 2064.

3

Bitcoin *halvings* are scheduled events that cut the issuance of new bitcoin in half

0	210,000	420,000	630,000	**840,000**
(Genesis)	(1st halving)	(2nd halving)	(3rd halving)	(4th halving)

50 BTC/block
(0th epoch)

25 BTC/block
(1st epoch)

12.5 BTC/block
(2nd epoch)

6.25 BTC/block
(3rd epoch)

3.125 BTC/block
(4th epoch)

January 3, 2009

November 28, 2012

July 9, 2016

May 11, 2020

April 20, 2024[1]

1

Four-year periods (epochs)

They are scheduled to happen every 210,000 blocks[2] starting from Bitcoin's very first block. Given the network's target block time of 10 minutes, the time between two consecutive halvings is roughly 4 years.[3]
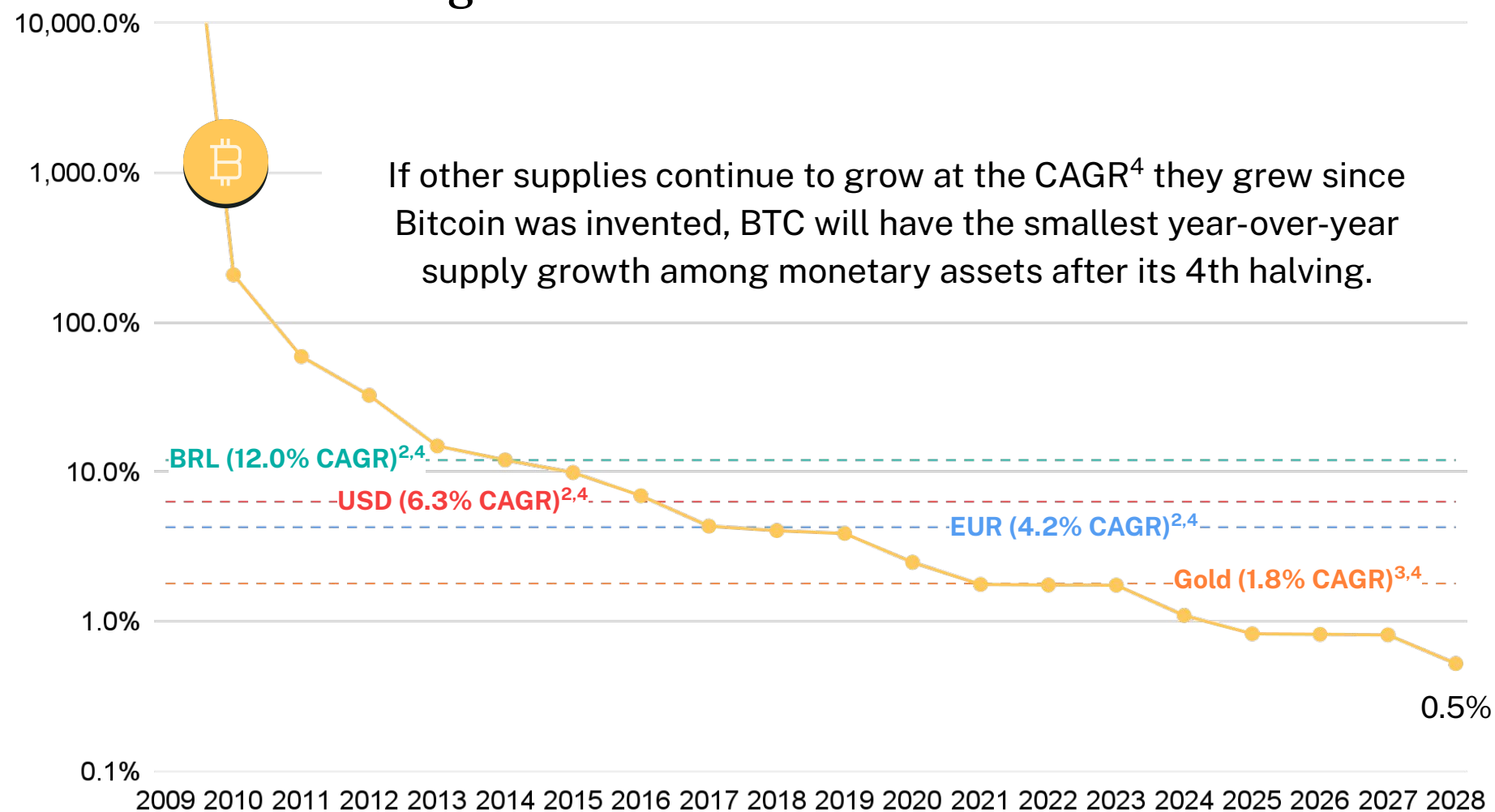
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50% reduction in mining subsidies (BTC issuance)

Halvings cut in half the issuance of new bitcoin subsidies to miners, reducing the token's rate of supply growth and increasing the rarity of newly available bitcoin on the market.

1 Halving date on April 20, 2024 according to Clark Moody. The date is probabilistic rather than deterministic and could vary depending on the hash rate of the Bitcoin network.
2 Bitcoin blocks include the record of a group of transactions and, once mined, make up the immutable blockchain.
3 Since Bitcoin's hash rate generally grows with time, and the network's mining difficulty is only adjusted on average every two weeks, the actual average block time between two consecutive halvings is historically shorter than 10 minutes, making the spacing between two consecutive events smaller than 4 years.

4

BTC will soon have the smallest supply growth rate compared to gold and fiat currencies

YoY (year-over-year) money supply growth of BTC against other historical CAGRs[1,2,3,4]

If other supplies continue to grow at the CAGR[4] they grew since Bitcoin was invented, BTC will have the smallest year-over-year supply growth among monetary assets after its 4th halving.

BRL (12.0% CAGR)[2,4]
USD (6.3% CAGR)[2,4]
EUR (4.2% CAGR)[2,4]
Gold (1.8% CAGR)[3,4]

Money Supply CAGRs[1,2,3,4]

Period	Since 2009	Since 2014	Since 2019	2024-2028
USD	6.3%	6.5%	7.6%	?
EUR	4.3%	5.1%	5.3%	?
BRL	12.0%	11.5%	16.1%	?
Gold	1.8%	1.8%	1.8%	?
BTC	**136.0%**	**4.8%**	**2.3%**	**0.8%**

1 Bitcoin historical supply from Dune Analytics. Projected issuance schedule and annualized inflation rate until the end of 2028 assume the theoretical bitcoin issuance curve and 10 minute average block times.
2 Dollar, Euro and Brazilian Reais are represented by their corresponding M2 monetary aggregates. M2 sources: https://fred.stlouisfed.org/series/M2SL, https://data.ecb.europa.eu/data/datasets/BSI/BSI.M.U2.N.V.M20.X.1.U2.2300.Z01.E, https://www.bcb.gov.br/en/statistics/monetary-statistics-depository-corporations-survey.
3 Gold's growth rate computed from the 2023 end-of-year supply and annual mined supply (both in tonnes) since 2009 with data from the World Gold Council.
4 CAGR stands for compound annual growth rate. CAGRs computed since the beginning of 2009, 2014 and 2019 until the end of 2023. BTC's initial supply equal to 50 coins as of the Genesis block on January 3, 2009. Chart uses CAGRs since 2009.

Bitcoin's supply rate trends toward zero

YoY supply growth of different monies since Bitcoin's inception[1,2,4]

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
USD	2.2%	4.3%	10.3%	7.7%	5.9%	5.9%	6.1%	6.4%	4.4%	4.0%	6.7%	25.7%	11.5%	-1.6%	-2.0%	?	?	?	?	?
EUR	2.1%	2.4%	2.3%	4.3%	2.2%	4.9%	5.5%	5.0%	4.7%	4.3%	5.8%	11.1%	7.1%	3.8%	-0.8%	?	?	?	?	?
BRL	9.1%	17.9%	18.3%	7.8%	12.6%	9.8%	6.3%	3.9%	6.3%	9.6%	9.0%	28.2%	8.2%	19.7%	16.4%	?	?	?	?	?
Gold	1.7%	1.7%	1.7%	1.7%	1.8%	1.8%	1.9%	1.9%	1.9%	1.9%	1.8%	1.8%	1.8%	1.8%	1.7%	?	?	?	?	?
BTC	3.3M%	208.4%	59.2%	32.6%	14.9%	12.0%	9.9%	6.9%	4.3%	4.1%	3.9%	2.5%	1.8%	1.8%	1.8%	1.1%	0.8%	0.8%	0.8%	0.5%

Predefined issuance schedule that, unlike gold and fiat, allows us to predict future supply with very good accuracy.

1 Bitcoin historical supply from Dune Analytics. Projected issuance schedule and annualized inflation rate until the end of 2028 assume the theoretical bitcoin issuance curve and 10 minute average block times.
2 Dollar, Euro and Brazilian Reais are represented by their corresponding M2 monetary aggregates. M2 sources: https://fred.stlouisfed.org/series/M2SL, https://data.ecb.europa.eu/data/datasets/BSI/BSI.M.U2.N.V.M20.X.1.U2.2300.Z01.E, https://www.bcb.gov.br/en/statistics/monetary-statistics-depository-corporations-survey.
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Does the halving present any risks?

1. Hash rate and security

Hash rate is the measure of computational power employed by Bitcoin's miners to create new blocks and immutably register transactions.

2. Hash rate dips are short-lived

Dips have happened from less efficient miners shutting down operations due to reduced revenue, but they have always been short-lived.

3. New security levels have always been reached in the mid-to-long term

After 12 months or more, Bitcoin's security level has always reached new highs.[1]

Change in Bitcoin's hash rate # months after previous halvings[1,2]

Halving	1 month	3 months	6 months	12 months	18 months	24 months	36 months
1st	-14%	8%	234%	19k%	307k%	1M%	2M%
2nd	-21%	31%	37%	208%	902%	2k%	4k%
3rd	0%	3%	-2%	40%	35%	79%	186%

After 12 months or more, **hash rate has always risen significantly.**

Are halvings priced in? History suggests "no"

Bitcoin's average performance has historically accelerated 3 months following previous halvings events

While each cycle has its own dynamics, historically, average excess returns for bitcoin comparing the same number of months prior to and following halving events have been the strongest in both 12 and 18 month windows.

Although bitcoin had positive price performance preceding the next halving, history suggests that — while halving dates are known in advance with a high degree of accuracy — prices are more positively affected several months following each event.[1,2]

Excess returns of # months after vs # months before previous halvings[1,2]
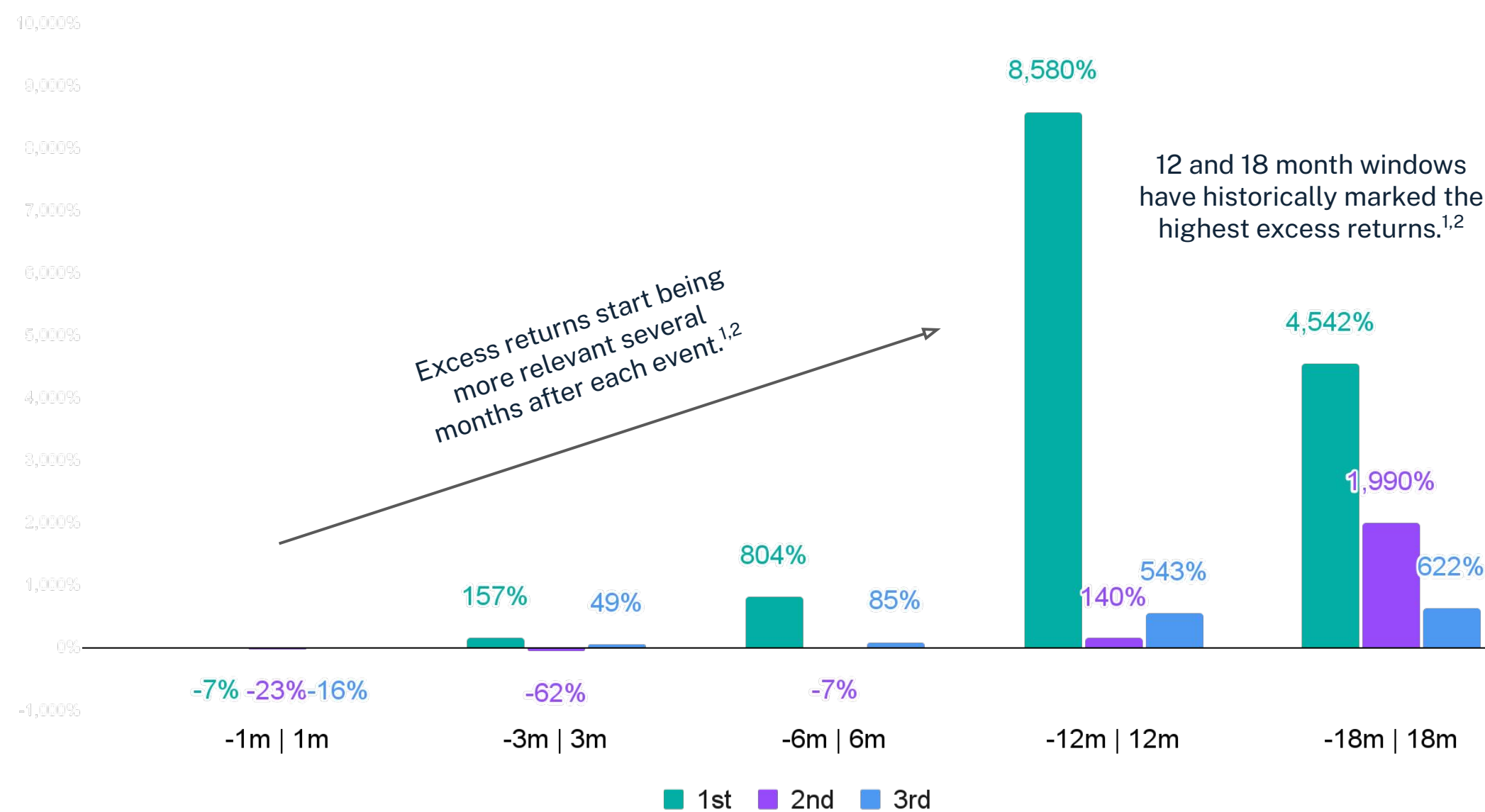
12 and 18 month windows have historically marked the highest excess returns.[1,2]

Excess returns start being more relevant several months after each event.[1,2]

| | 1st | 2nd | 3rd |

8

Prior cycles peaked 12 to 18 months after halvings[1]
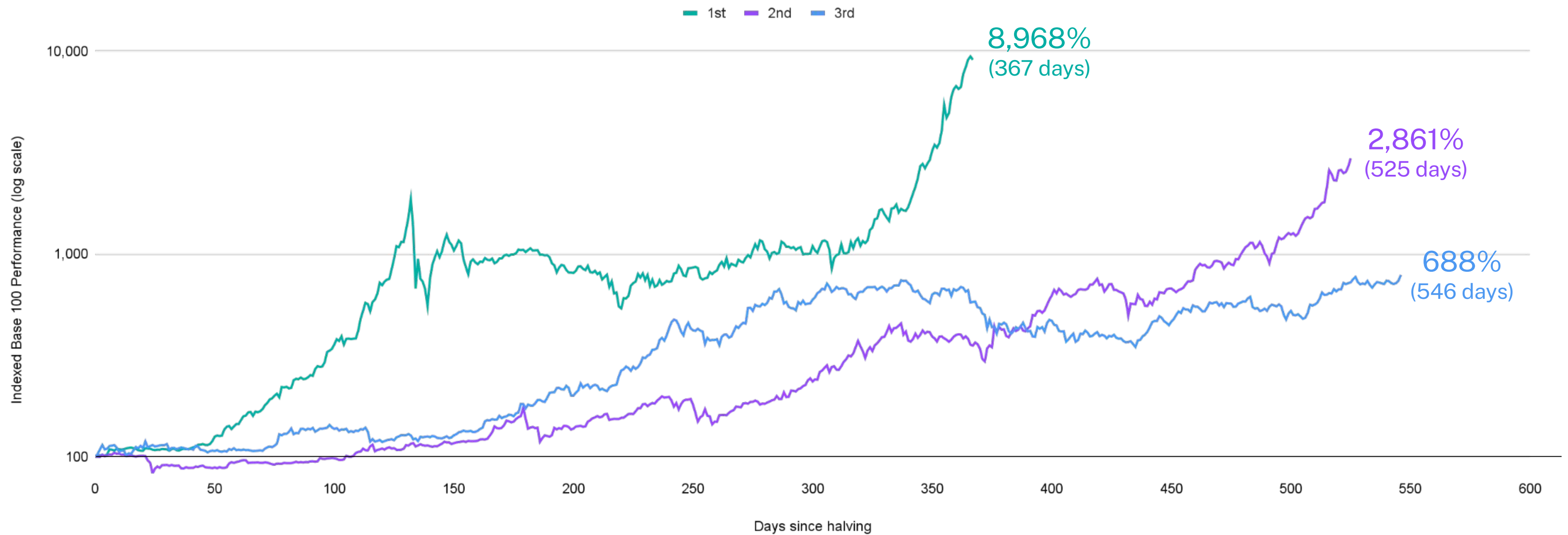
This cycle could peak 12 to 18 months after the halving, with bitcoin significantly above $100,000[1]

Projection based on prior cycles indexed performance and assuming $70,000 on the halving.[1]

$233,260

$162,734

$134,283

4th

3rd

Peak at "fair" valuation 12 months after the halving.[1]

Peak at "fair" valuation 18 months after the halving.[1]

2nd

1st

Price (log scale)

Historically, BTC has only surpassed its long-term "fair" value trend several months after halving events, staying above it throughout the post-halving year. While already at all-time high territory, BTC is still below "fair" value and on track with prior halving cycles.[1]

1 We describe the long term growth of the bitcoin price by a logarithmic regression line, which models exponential growth including diminishing returns. Trend line is derived from a logarithmic regression trend fitted to bitcoin's market capitalization and a modeling of the future bitcoin supply based on its issuance schedule (assuming an average block time of 10 minutes). Model uses Glassnode data from July 17, 2010 to December 31, 2022. Everything since the beginning of 2023 is a prediction. Actual bitcoin prices retrieved from Messari from July 21, 2010 to March 31, 2024. Exponential decay projection assumes bitcoin will be at $70,000 in its 4th halving. **Past performance is not a guarantee of future results.**

10
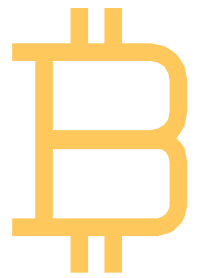
1

Halvings reassure bitcoin's immutable monetary policy

These events are key to increasing bitcoin's scarcity, reassuring the social consensus around the asset's immutable and disinflationary monetary policy.

2

The forthcoming halving is likely not fully priced in

While prices have moved considerably before prior events, the strongest returns for bitcoin have happened in the 12 to 18 months window following each prior halving.

3

Bitcoin could exceed $100,000 after the next event[1]

Bitcoin's long-term growth trend and prior halving performances until major all-time highs point to a possible cycle peak 12 to 18 months after the forthcoming halving, with BTC exceed $100,000 in more conservative scenarios.

1 **Past performance is not a guarantee of future results.**

Frequently Asked Questions[1]

1. Is the circulating supply of bitcoin cut in half during halving events?

No. Halvings reduce the number of new bitcoins issued per block by 50%. The first halving reduced newly issued bitcoin per block from 50 BTC to 25 BTC; the second, from 25 BTC to 12.5 BTC; and the third, from 12.5 BTC to 6.25 BTC. The forthcoming halving will reduce newly issued BTC block from 6.25 BTC to 3.125 BTC.

2. Is the Bitcoin code updated before halvings take place?

No. Halving events are pre-programmed in the Bitcoin code since its first release by Satoshi Nakamoto in 2009. As such, no software update or fork is necessary for the events to take place ever 210,000 block interval since the genesis block.

3. How many halvings will the Bitcoin network go through?

Since the smallest bitcoin fraction, called a *satoshi*, is equal to 0.00000001 BTC, the Bitcoin network will go through a total of 32 halvings until the last satoshi is mined and all the 21 million BTC are put in circulation by miners. Assuming 10 minute average block times, the 32nd and final Bitcoin halving should occur around the year 2140.

4. Why did Satoshi include halvings in bitcoin's monetary policy?

While Satoshi design choices are always open for debate, one possible interpretation is that Satoshi included halvings as a means to better reward early adopters during Bitcoin's infancy, a period in which the network activity was timid and transaction fees weren't big enough to incentivize independent actors to secure the network.

5. After all BTC are issued, what will be the incentive for miners to keep securing Bitcoin?

As the adoption of the Bitcoin network grows, competition for Bitcoin's block space rises as well. This leads transaction fees to increase as some users start paying miners more to have their transactions prioritized. As this process unfolds, total paid fees are likely to reach high enough levels that incentivize miners to keep employing computational power to secure the Bitcoin network.

6. Is there an easy way to know the share of the 21 million supply issued in a halving epoch?

Yes. The number of BTC issued per block in any halving epoch is also equal to the percentage of the total supply issued in that epoch. This number is also equal to all the BTC that will be mined in all remaining epochs. In the initial epoch (blocks 0-209,999), 50% of the total BTC were mined, with 50% remaining. In the 1st epoch (blocks 210,000-419,999), 25% more were mined, with 25% left to all future epochs. In the 2nd epoch (blocks 420,000-629,999), 12.5% were mined, with 12.5% left to all future epochs, etc.

Important disclaimers