March 21, 2022

Bitooda

Bitcoin and the Public Markets

Valuation Focus: Bitcoin Miners Look Rich Compared to Future BTC Mined vs. Similar Oil & Gold Metrics

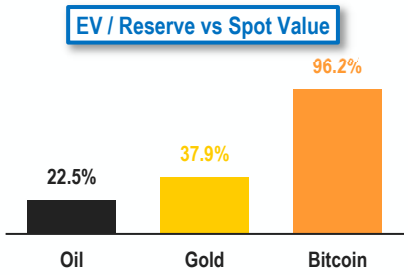
Our last Weekly Hash drew attention to our projected growth in network Hashrate as well as daily revenue per PH/s in BTC terms, given our (possibly slightly optimistic) projections for growth in transaction (Tx) fees. Note that long term Hashrate growth is dependent on price appreciation driving adequate revenue per MWh of mining computing power to keep mining sustainable.

This report focuses on the valuation implications of the network Hashrate for the public miners. Inside the report, we do cover our regular sections: macro markets, fund flows and CME positioning, but the focus is on public miners.

By our assessment, a Petahash/s of hashing capacity is projected to mine 1.424BTC in 2022, and 0.808BTC in 2023 (slide 6). From 1/1/2023 through 12/31/2030, our model projects 1PH/s to mine a total of 2.129BTC. 2023 represents ~38% of this 2.129 BTC, in part because of the impact of the 2024 halving.

Commodity extracting industries, such as oil & gas and gold miners, trade at an EV / unit of reserve. The EV of Exxon Mobil, for example, is compared to the proven reserves in barrels of oil equivalent, or EV per oz of proven gold reserve in the case of gold miners. The oil group trades at an EV of $25 per BoE, or 22% of the current spot price of oil, while the gold group trades at $733 per oz gold reserves, or 38% of spot. The notion is that as an investor, I can buy 1 oz of gold or invest in the company to own 1 oz of future gold. The reason 1 oz equivalent of the company is cheaper than spot is because there are operating costs and future capital expenditures required to extract that gold.

We view an investment in a Bitcoin miner similarly: an investment in the miner gives us a proportional share of future bitcoin mined, with the need to account for future operating expenses to run the miners as well as "sustaining capex", the capex needed to support and upgrade the existing Hashrate. Thus, the price an investor should be willing to pay to own 1 Bitcoin "in the ether" by proxy through stock ownership should be less than the spot price of Bitcoin by the opex and capex required to mine it, with an additional time value component as well. For every Bitcoin that a miner will mine over the years, the valuation should be a modest fraction of the current spot price of BTC.



The 18 publicly listed mining stocks trade at an average adjusted Enterprise Value per YE 2022 PH/s of planned capacity of $110k, up $20k WoW. We adjust based on balance sheet crypto holdings. Adjusted EV = Market Cap + Debt – Cash – Market Value of Crypto Holdings. We also examined financials based on Bloomberg analyst consensus, finding that the companies that do have estimates trade at 3.7x 2022E EBITDA and 6.8x 2022E Contribution (Gross Profit + Depreciation). Consensus estimates (slide 17) call for $3B in EBITDA (11/18 miners) on ~$4.7B in revenue (estimates on 13/18 miners). Considering our 327EH/s year end network Hashrate estimate, we suspect that consensus EBITDA estimates may need downward revisions unless Bitcoin price accelerates to new highs.

Key Takeaways

- *Bitcoin miners trade at an adjusted EV per BTC in reserve of $39,676, a small discount to the $41,095 spot price*
- *We assess that Bitcoin miners as a group should be trading at a much more significant discount to the spot price of BTC than the ~4% the group currently exhibits*
- *We would expect differences in business models, cost structures, capitalization and alternate revenue streams to account for some the valuation variance within the group*

Research

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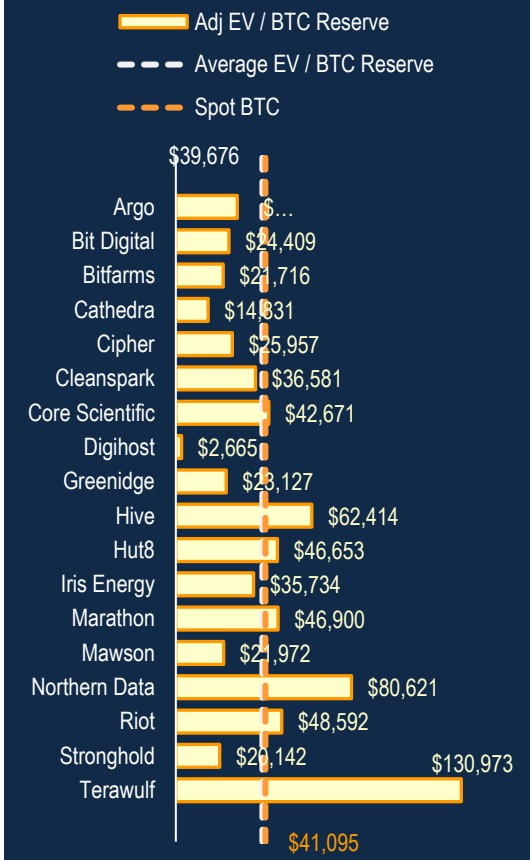
BTC Price (3/21 at 4pm ET)	$41,095
Obs Hashrate	198 EH/s



Bitcoin Mining Reserve

BitOoda 2022 Hash Estimates
~327 EH/s by Year End

- Our projections call for a target Hashrate of ~327EH/s by year end 2022
- This is slightly below our most recent prior estimate of 334EH/s and represents 88% year-on-year growth vs. December 2021
- We expect power infrastructure to be the gating factor in mining expansion earlier in the year, but to start easing later in the year, with semiconductor availability the ultimate limiting issue
- **The Hashrate growth pace averages 12.8 EH/s per month, but we assess deployments will be somewhat back-end loaded**
- **However, Hashrate growth YTD has exceeded our model projections**

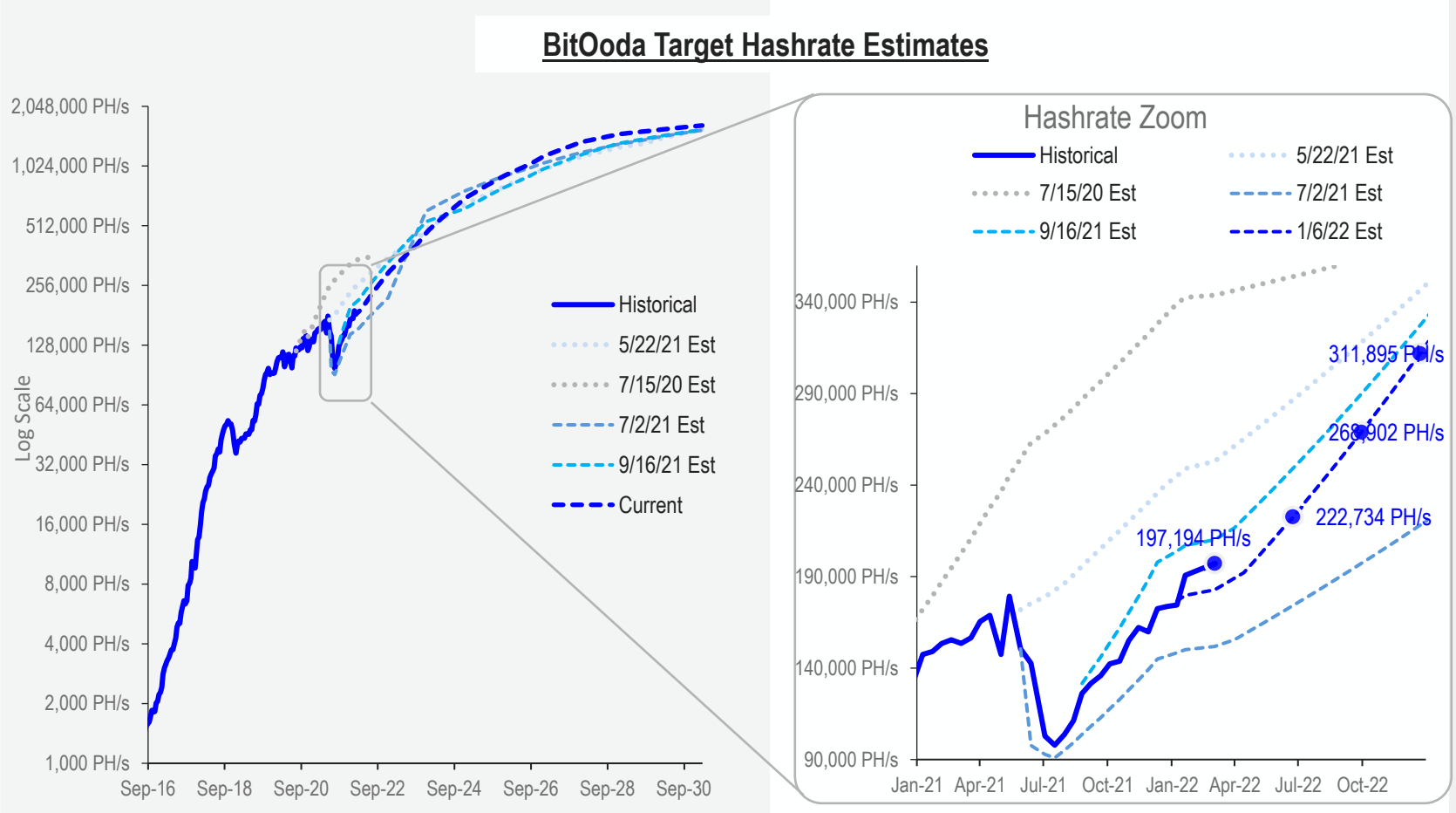


Figure: Historical and Estimated Target Hashrate 2017-2030
Historical as of 2/15/21; Estimates as of current, 9/16/21, 7/2/21, 5/22/21, and 7/15/20

Source: BitOoda estimates, CoinMetrics

Bitcoin Network Rewards:
Slowly Tx Fee Centric

- Our projections call for total daily mining rewards to slowly transition toward more Transaction Fee centric rather than Block Reward centric
- However, Tx Fees are currently tracking below our prior estimates
- We assess this is driven by the shift of many exchanges to settling inter-exchange transactions via stablecoins rather than BTC, reducing network congestion and thus fees
- Secondarily, we assess more BTC is held on-exchange in western countries than in Asia, so the shift of trading activity to the west from (especially) China leads to lower on-chain Tx volumes; and – although still early days – the growing adoption of the Lightning Network also reduces on-chain volumes
- **Thus, there may be downside risk to our Tx Fee projections, but current estimates suffice for the present analysis**

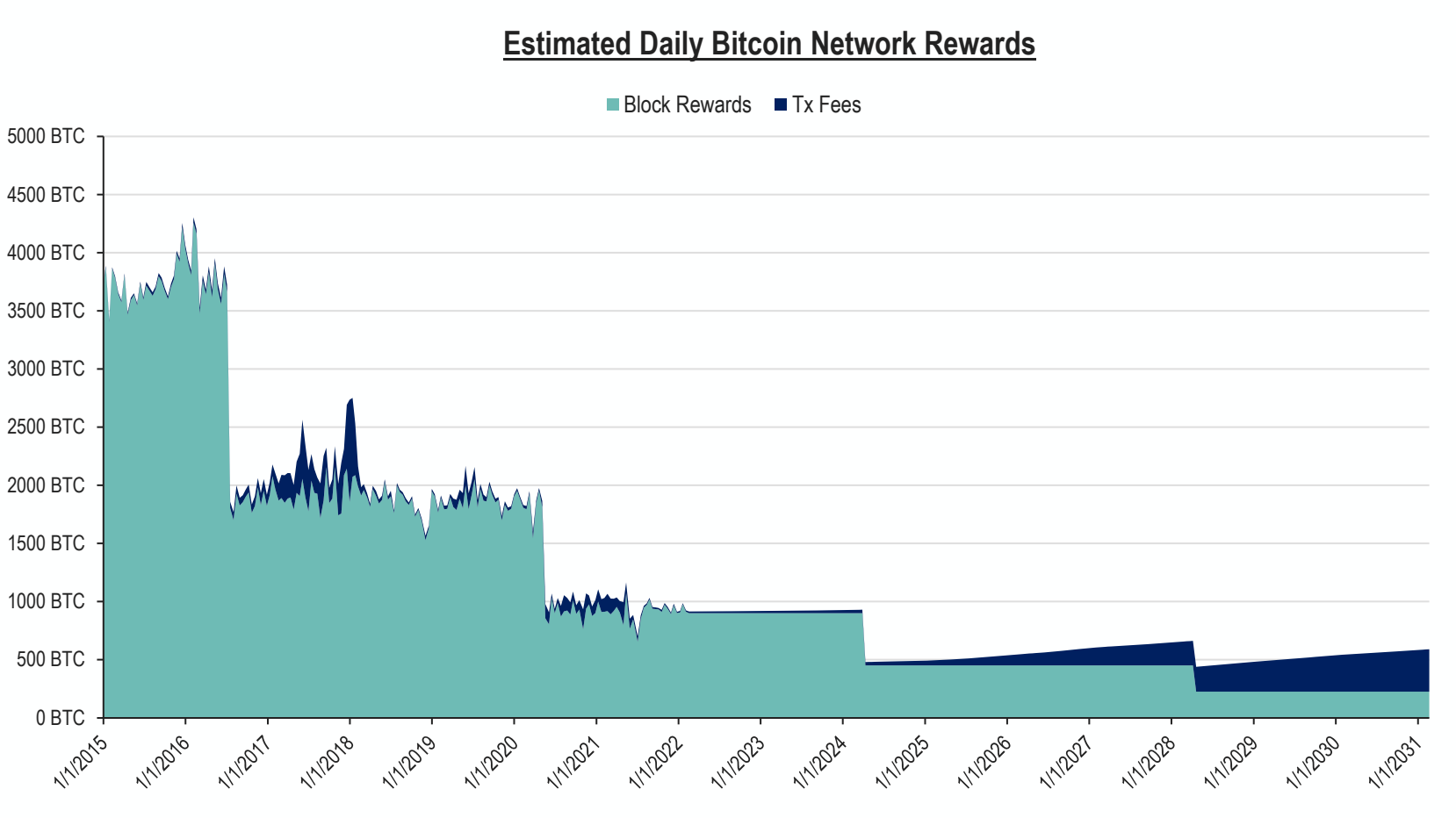


Figure: Historical and Estimated daily rewards to Bitcoin mining network, 1/1/2015 through 2031
Historical as of 3/15/22

Source: BitOoda estimates, CoinMetrics

BTC Revenue per PH/s per Day
Decaying With Rising Hashrate

- We model out the decline in daily revenue per 1PH/s unit of Hashrate as the network expands
- The number stabilizes after the 2028 halving on the assumption that Tx Fees continue to grow and outweigh the further network Hashrate growth
- However, this is predicated on increasing network congestion, which is by no means certain
- **Thus, there may be downside risk to the Tx Fee component of revenue projections**

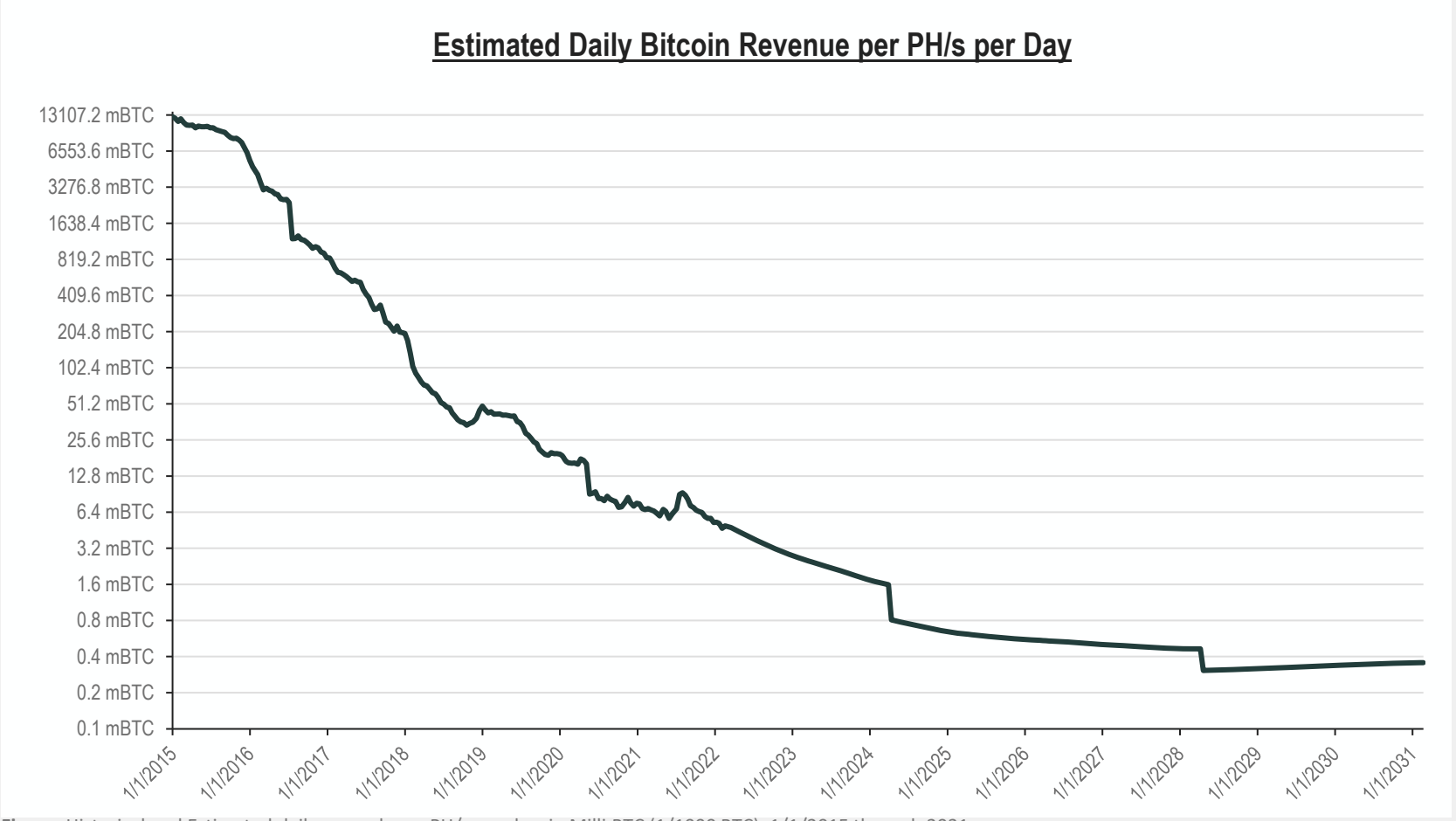


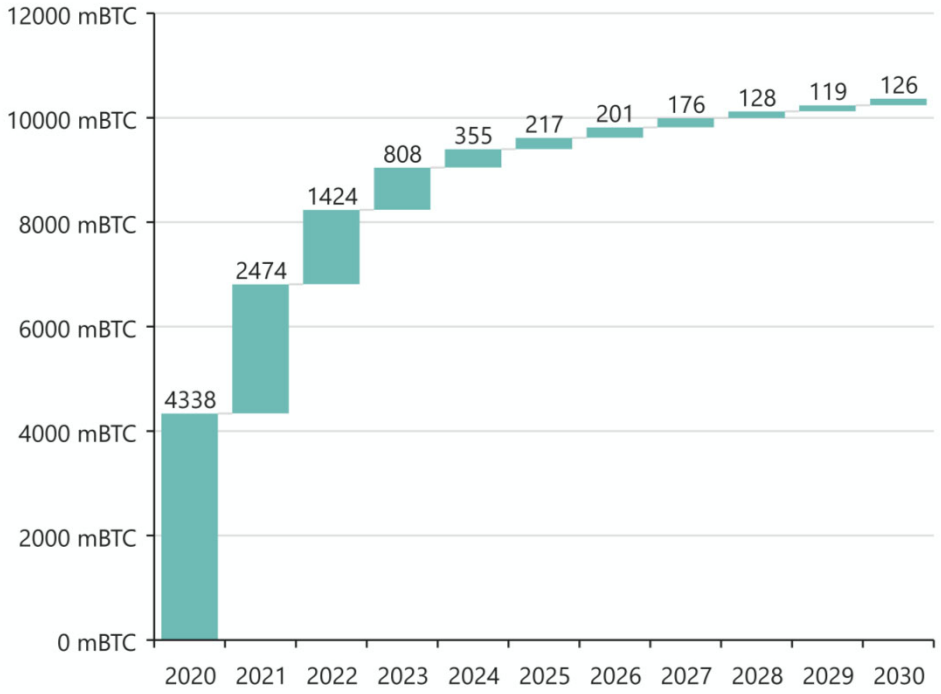
Figure: Historical and Estimated daily rewards per PH/s per day, in Milli BTC (1/1000 BTC), 1/1/2015 through 2031
Historical as of 3/15/22

Source: BitOoda estimates, CoinMetrics

BTC Mining Reserve per PH/s
Declining Rapidly With Rising Hashrate

- The chart below shows our estimate of annual BTC earned per PH/s operating continuously for each full year
- The chart shows that there is a real cost to delaying production: running a PH/s per day for all of 2020 would have earned 4338 milli BTC or 4.3 BTC. The same PH/s running from 1/1/2023 to 12/31/2023 would earn just 808mBTC or 0.8BTC
- A facility coming online on 1/1/2023 will earn 2.129BTC for every PH/s they operate through 2030 ***assuming no downside to our Tx fee projections***

Total Annual BTC Earned per PH/s per Day, in mBTC



	Total Rewards / PH/s in mBTC
2020	4338
2021	2474
2022	1424
2023	808
2024	355
2025	217
2026	201
2027	176
2028	128
2029	119
2030	126

Figure: Historical and Estimated total annual earnings per PH/s per day, in Milli BTC (1/1000 BTC)
Historical as of 3/15/22

Source: BitOoda estimates, CoinMetrics

Public Miner Valuation:

Bitcoin Mining Reserve

EV vs Reserves:
Oil & Gold Case Studies

- In many commodity markets, an investor has the option to own the stock of producers or directly own the underlying commodity, either physically or through financial products
- Admittedly, institutional options for direct ownership of Bitcoin are somewhat more limited than more established commodities
- We propose a framework to value Bitcoin miners on a similar metric to other commodity producers
- Oil and gold producers below trade at a steep discount to the spot value of their proven reserves
- This intuitively makes sense: there is both an operating cost and a capital cost to extract gold / oil, so an investor should value reserves on a capital-cost adjusted basis

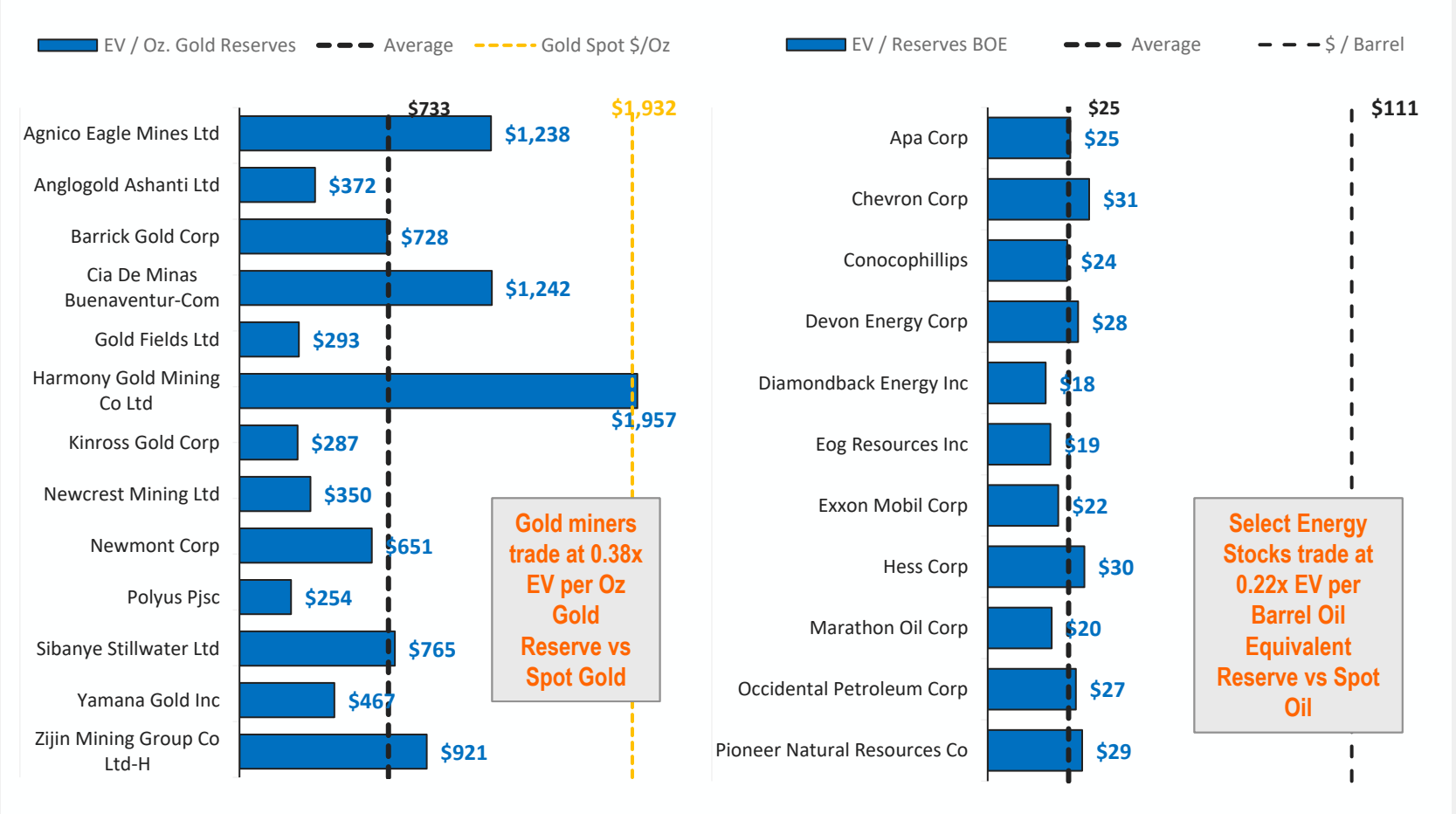


Figure: Enterprise Value vs Reserves or "future production" Oil and Gold markets

Source: BitOoda, Bloomberg

Adjusted EV vs. BTC Reserves: Varies Widely…

- We used the preceding analysis of YE 2022 Hashrate to estimate the Bitcoin mined by each company in 2023 and beyond.
- For 2022 production, we used an average of current and year end Hashrate, adjusting for declining BTC / PH/s as more Hashrate comes online.
- Based on these estimates, we forecast a "Bitcoin Reserve" for each company
- This is based on 2022 YE Hashrate and may not fully adjust for capex needed to achieve the Hashrate
- Further capex would be needed to sustain the Hashrate over time, as well as to grow it further.
- **Further Hashrate growth is not examined in this analysis: since capex for such growth is not accounted for in the EV numerator, we do not increase the Bitcoin reserve denominator**

Name	Ticker	Adj EV ($mm)	Current Hashrate	2022 YE Hashrate	BTC Mined				Adj EV / BTC Reserve
					2022	2023	Beyond 2023*	Total	
Argo	ARBK	$302	1605 PH/s	3700 PH/s	2833 BTC	2990 BTC	4888 BTC	10710 BTC	$28,217
Bit Digital	BTBT	190	1603	2603	2246	2103	3439	7788	$24,409
Bitfarms	BITF	501	2300	8200	5607	6626	10832	23065	$21,716
Cathedra	CBIT CN	30	187	725	487	586	958	2031	$14,831
Cipher	CIFR	553	0	8000	4272	6464	10568	21304	$25,957
Cleanspark	CLSK	469	2200	4370	3508	3531	5773	12812	$36,581
Core Scientific	CORZ	2523	8200	20560	15358	16612	27160	59130	$42,671
Digihost	DGHI	26	415	3600	2144	2909	4756	9808	$2,665
Greenidge	GREE	307	1400	4700	3257	3798	6209	13264	$23,127
Hive	HIVE	539	1870	2870	2531	2319	3791	8641	$62,414
Hut8	HUT	618	2360	4500	3663	3636	5945	13244	$46,653
Iris Energy	IREN	631	800	6471	3883	5229	8548	17659	$35,734
Marathon	MARA	2898	3500	22500	13884	18180	29723	61787	$46,900
Mawson	MIGI	256	1100	4150	2804	3353	5482	11639	$21,972
Northern Data	NB2 GY	1074	2000	4600	3524	3717	6077	13318	$80,621
Riot	RIOT	1745	3400	12800	8651	10342	16909	35902	$48,592
Stronghold	SDIG	491	1300	8900	5447	7191	11757	24395	$20,142
Terawulf	WULF	774	100	2200	1228	1778	2906	5912	$130,973
Total		**$13,927**	**34340 PH/s**	**125449 PH/s**	**85327 BTC**	**101363 BTC**	**165718 BTC**	**352408 BTC**	**$39,518**

Figure: Enterprise Value vs Reserves or "future production" of Bitcoin

Source: BitOoda, Bloomberg

BTC Miners Trading Near Spot BTC

- The chart below shows that many miners are trading at an adjusted EV / BTC in reserve very close to or above spot
- While some such miners have other revenue streams, including hosting, or alternate crypto / GPU mining / high performance compute, most do not.
- Note that the adjusted EV metric in the numerator already excludes the present value of all disclosed treasury BTC / other crypto
- Considering there would be both opex and capex needed to "extract" a Bitcoin, one would expect stocks trading at lower EV / BTC to be more attractive, although variations in business models (self mining, hosted, etc.), current degree of capital funding, and power / hosting costs do have an impact

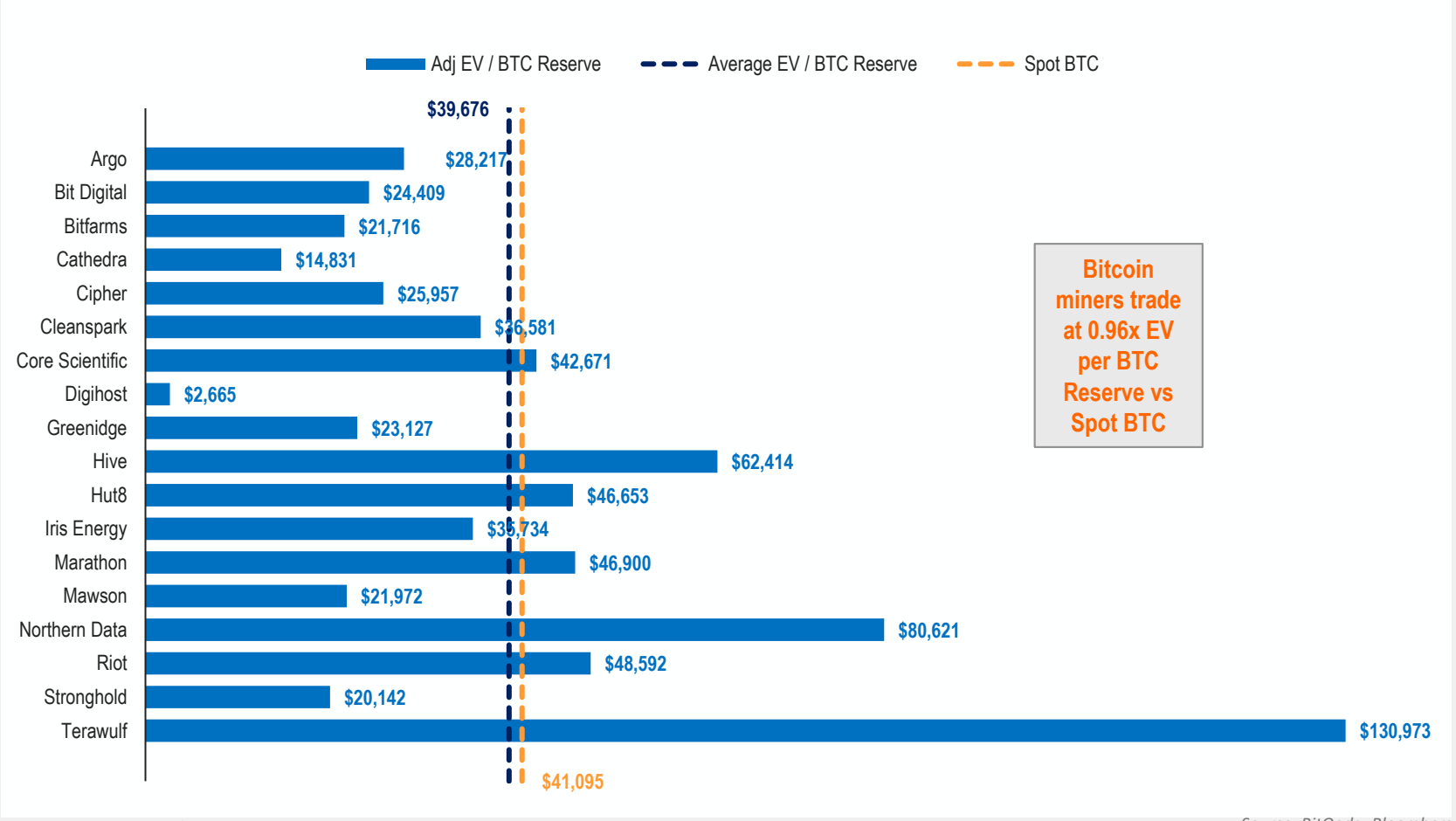


Figure: Enterprise Value vs Bitcoin Reserves

Source: BitOoda, Bloomberg

BTC Miners Richly Valued
vs. Oil & Gold Examples

- Oil producers trade at 22.5% of current spot oil – reflecting both extraction costs, future capex, and the current run-up in oil prices with the conflict in Ukraine
- Gold miners trade at ~38% of spot gold, reflecting both all-in sustaining capex and mining production costs
- By the same token, there is an ongoing capex to maintain Hashrate once companies achieve their announced deployments
- Additionally, it takes an increasing amount of power to produce future Bitcoin
- **Thus, we assess that Bitcoin miners as a group should be trading at a much more significant discount to the spot price of BTC than the ~4% the group currently exhibits**

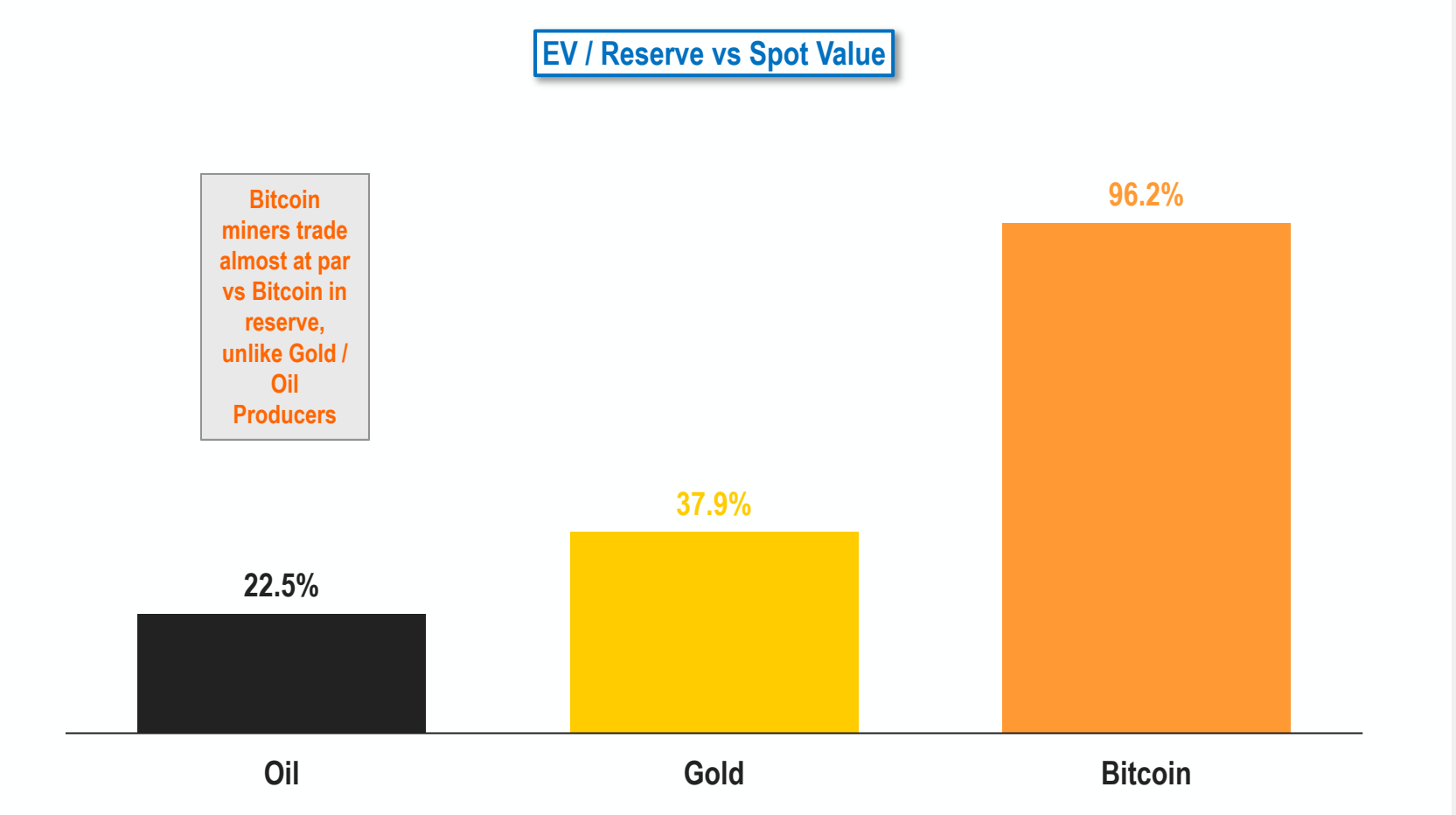


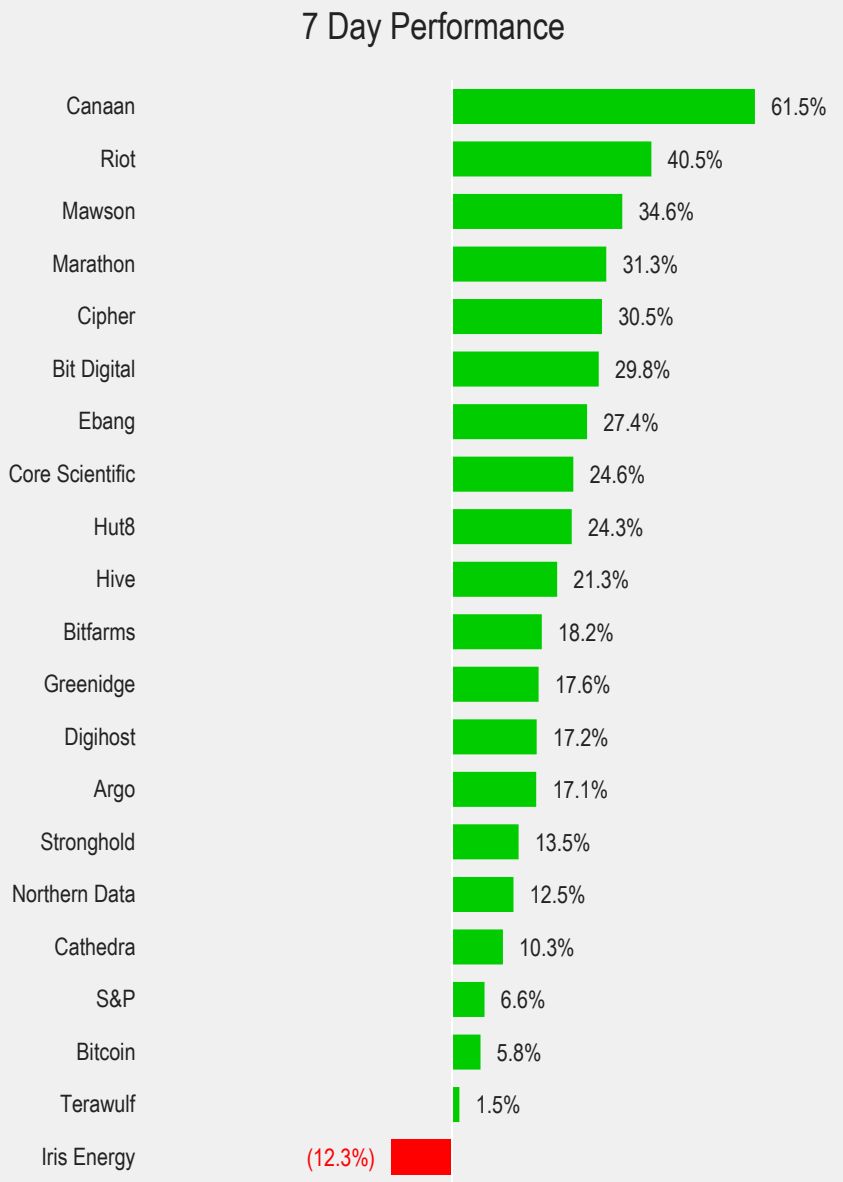
Figure: Comparing EV/ Reserves vs. Spot prices for Oil, Gold & Bitcoin

Source: BitOoda, Bloomberg

Bitcoin Miners
Performance Map

- Only Cathedra and the two hardware makers, Canaan and Ebang, have outperformed Bitcoin YTD
- However, most miners have outperformed Bitcoin over the past one week

Year to Date	Quarter to Date	Month to Date	30 Day	7 Day	1 Day
				Canaan, 61.5%	
				Riot, 40.5%	
				Mawson, 34.6%	
				Marathon, 31.3%	Terawulf, 7.9%
				Cipher, 30.5%	Greenidge, 4.1%
				Bit Digital, 29.8%	Cipher, 3.3%
				Ebang, 27.4%	Core Scientific, 3.3%
				Core Scientific, 24.6%	Canaan, 3.0%
		Riot, 15.4%		Hut8, 24.3%	Digihost, 2.8%
		Cipher, 13.8%		Hive, 21.3%	Iris Energy, 2.1%
		Marathon, 10.9%		Bitfarms, 18.2%	Riot, 1.8%
		Cathedra, 9.3%	Cipher, 23.5%	Greenidge, 17.6%	Cathedra, 1.4%
		Ebang, 6.0%	Mawson, 23.3%	Digihost, 17.2%	Ebang, 1.1%
Ebang, 28.6%	Ebang, 28.6%	Canaan, 2.7%	Marathon, 17.7%	Argo, 17.1%	Marathon, 0.7%
Canaan, 5.1%	Canaan, 5.1%	S&P, 1.7%	Riot, 17.2%	Stronghold, 13.5%	Northern Data, 0.0%
S&P, (6.7%)	S&P, (6.7%)	Mawson, 1.1%	Core Scientific, 10.9%	Northern Data, 12.5%	Hut8, (0.3%)
Cathedra, (9.2%)	Cathedra, (9.2%)	Bitfarms, (0.3%)	Cathedra, 9.9%	Cathedra, 10.3%	Bit Digital, (0.3%)
Riot, (10.9%)	Riot, (10.9%)	Core Scientific, (0.4%)	Bitfarms, 9.0%	S&P, 6.6%	S&P, (0.3%)
Bitcoin, (11.6%)	Bitcoin, (11.6%)	Bitcoin, (1.7%)	Bitcoin, 2.6%	Bitcoin, 5.8%	Bitcoin, (0.8%)
Marathon, (14.4%)	Marathon, (14.4%)	Hive, (2.5%)	S&P, 2.3%	Terawulf, 1.5%	Hive, (2.0%)
Core Scientific, (16.3%)	Core Scientific, (16.3%)	Argo, (2.6%)	Hive, 1.0%	Iris Energy, (12.3%)	Bitfarms, (3.1%)
Iris Energy, (16.8%)	Iris Energy, (16.8%)	Hut8, (5.8%)	Ebang, 0.4%		Argo, (5.3%)
Stronghold, (22.3%)	Stronghold, (22.3%)	Bit Digital, (6.9%)	Iris Energy, (0.7%)		Stronghold, (8.3%)
Hive, (24.6%)	Hive, (24.6%)	Iris Energy, (10.2%)	Argo, (2.1%)		Mawson, (10.8%)
Cipher, (25.1%)	Cipher, (25.1%)	Greenidge, (10.6%)	Stronghold, (2.9%)		
Bitfarms, (25.5%)	Bitfarms, (25.5%)	Northern Data, (10.7%)	Hut8, (3.1%)		
Hut8, (26.7%)	Hut8, (26.7%)	Digihost, (17.0%)	Canaan, (5.6%)		
Argo, (26.8%)	Argo, (26.8%)	Stronghold, (20.8%)	Bit Digital, (5.9%)		
Mawson, (35.7%)	Mawson, (35.7%)	Terawulf, (30.9%)	Digihost, (8.4%)		
Digihost, (36.7%)	Digihost, (36.7%)		Greenidge, (10.9%)		
Northern Data, (39.5%)	Northern Data, (39.5%)		Northern Data, (15.5%)		
Bit Digital, (39.8%)	Bit Digital, (39.8%)		Terawulf, (31.7%)		
Terawulf, (46.4%)	Terawulf, (46.4%)				
Greenidge, (46.7%)	Greenidge, (46.7%)				



Source: BitOoda, Bloomberg

Trading Comparables

Miners Trade at an Adj EV of $110k per PH/s of 2022YE Hashrate

- Updated Hashrate and Bitcoin holdings for each of the miners reveals both a lower adjusted EV (on higher holdings) and a higher Hashrate. Adjusted EV is Market Cap + Debt – Cash – USD value of crypto holdings
- **The public companies have 34 EH/s operational, above our prior compilation of 24EH/s**
- This includes a placeholder for Terawulf, that just announced commencement of mining operations but did not disclose hashrate
- We exclude future capex commitments: for many miners, part of the balance sheet will be used to pay for delivery of future Hashrate, boosting adjusted EV. However, a lack of data for most companies makes this adjustment imprecise in practice
- On our preferred valuation metric, the group trades at an average of $770k per current operating PH/s and $110k per YE 2022 (up $20k WoW) expected PH/s

Trading Comparables

Name	Ticker	Price	52-week Range		Market Cap	Cash	Debt	Bitcoin on BS	Bitcoin on BS (USD)	Adj EV ($mm)	Hashrate			EV/ PH/s	
			Low	High							Current	2022 Deliveries	YE 2022	Current	2022YE
Bitcoin	XBTUSD Curncy	$41,094.62	$29,307.88	$68,991.85	$777,897										
S&P	SPX Index	4447.91	3853.5	4818.6	$39,305,573										
Nasdaq Comp	CCMP Index	13774.09	12555.4	16212.2	$23,651,885										
	Public Miners														
Argo	ARBK	$8.87	$7.25	$21.00	$415.1	$0.0	$0.0	2748 BTC	$112.9	$302.2	1605 PH/s	2000 PH/s	3700 PH/s	$0.19	$0.08
Bit Digital	BTBT	$3.48	$2.74	$20.74	$242.3	$26.5	$0.0	627 BTC	$25.8	$190.1	1603 PH/s	1000 PH/s	2603 PH/s	$0.12	$0.07
Bitfarms	BITF	$3.66	$2.75	$9.36	$723.7	$43.3	$21.1	4883 BTC	$200.7	$500.9	2300 PH/s	5900 PH/s	8200 PH/s	$0.22	$0.06
Cathedra	CBIT CN	$0.46	$0.29	$0.92	$40.5	$5.7	$0.6	129 BTC	$5.3	$30.1	187 PH/s	566 PH/s	725 PH/s	$0.16	$0.04
Cipher	CIFR	$3.34	$2.33	$15.39	$835.3	$282.3	$0.0	0 BTC	$0.0	$553.0	0 PH/s	8000 PH/s	8000 PH/s		$0.07
Cleanspark	CLSK	$12.02	$5.47	$24.89	$498.5	$6.0	$2.2	633 BTC	$26.0	$468.7	2200 PH/s	2170 PH/s	4370 PH/s	$0.21	$0.11
Core Scientific	CORZ	$8.91	$5.82	$14.98	$2,827.0	$1.6	$0.0	7355 BTC	$302.3	$2,523.1	8200 PH/s	12360 PH/s	20560 PH/s	$0.31	$0.12
Digihost	DGHI	$2.91	$2.42	$8.00	$72.6	$17.3	$2.5	770 BTC	$31.7	$26.1	415 PH/s	3185 PH/s	3600 PH/s	$0.06	$0.01
Greenidge	GREE	$8.17	$7.01	$60.00	$332.1	$51.6	$26.3	0 BTC	$0.0	$306.8	1400 PH/s	3300 PH/s	4700 PH/s	$0.22	$0.07
Hive	HIVE	$1.91	$1.50	$5.60	$781.1	$114.3	$15.7	3483 BTC	$143.1	$539.3	1870 PH/s	1000 PH/s	2870 PH/s	$0.29	$0.19
Hut8	HUT	$5.58	$3.15	$16.57	$956.7	$140.1	$40.7	5826 BTC	$239.4	$617.9	2360 PH/s	2140 PH/s	4500 PH/s	$0.26	$0.14
Iris Energy	IREN	$13.62	$8.55	$28.25	$749.6	$118.6	$0.0	0 BTC	$0.0	$631.0	800 PH/s	5671 PH/s	6471 PH/s	$0.79	$0.10
Marathon	MARA	$26.90	$18.32	$83.45	$2,772.1	$268.5	$728.4	8133 BTC	$334.2	$2,897.8	3500 PH/s	19000 PH/s	22500 PH/s	$0.83	$0.13
Mawson	MIGI	$4.12	$2.00	$17.25	$284.3	$32.4	$3.8	0 BTC	$0.0	$255.7	1100 PH/s	3050 PH/s	4150 PH/s	$0.23	$0.06
Northern Data	NB2 GY	$46.20	$38.10	$134.00	$1,073.7	$0.0	$0.0	0 BTC	$0.0	$1,073.7	2000 PH/s	2600 PH/s	4600 PH/s	$0.54	$0.23
Riot	RIOT	$19.38	$12.90	$61.55	$2,272.8	$323.1	$14.6	5347 BTC	$219.7	$1,744.5	3400 PH/s	9400 PH/s	12800 PH/s	$0.51	$0.14
Stronghold	SDIG	$9.97	$7.26	$35.80	$480.6	$41.4	$54.5	56 BTC	$2.3	$491.4	1300 PH/s	7600 PH/s	8900 PH/s	$0.38	$0.06
Terawulf	WULF	$7.76	$4.03	$43.98	$775.8	$1.5	$0.0	0 BTC	$0.0	$774.3	100 PH/s	2100 PH/s	2200 PH/s	$7.74	$0.35
Total					**$16,133.6**	**$1,474.2**	**$910.5**	**39990 BTC**	**$1,643.4**	**$13,926.6**	**34340 PH/s**	**91042 PH/s**	**125449 PH/s**	**$0.41**	**$0.11**
Average					**$896.3**	**$81.9**	**$50.6**	**2222 BTC**	**$91.3**	**$773.7**	**1908 PH/s**	**5058 PH/s**	**6969 PH/s**	**$0.77**	**$0.11**
Median					**$736.6**	**$36.9**	**$2.3**	**630 BTC**	**$25.9**	**$520.1**	**1604 PH/s**	**3118 PH/s**	**4550 PH/s**	**$0.26**	**$0.09**

Figure: Comparable analysis: Adjusted Enterprise Value per PH/s of YE 2022 Capacity

Source: BitOoda, Bloomberg

Adj EV / 2022YE PH/s
Average of $110k

- The chart shows the adjusted EV per PH/s of expected 2022 YE Hashrate valuation
- The group trades at an average of $110k per future PH/s, up $20k WoW

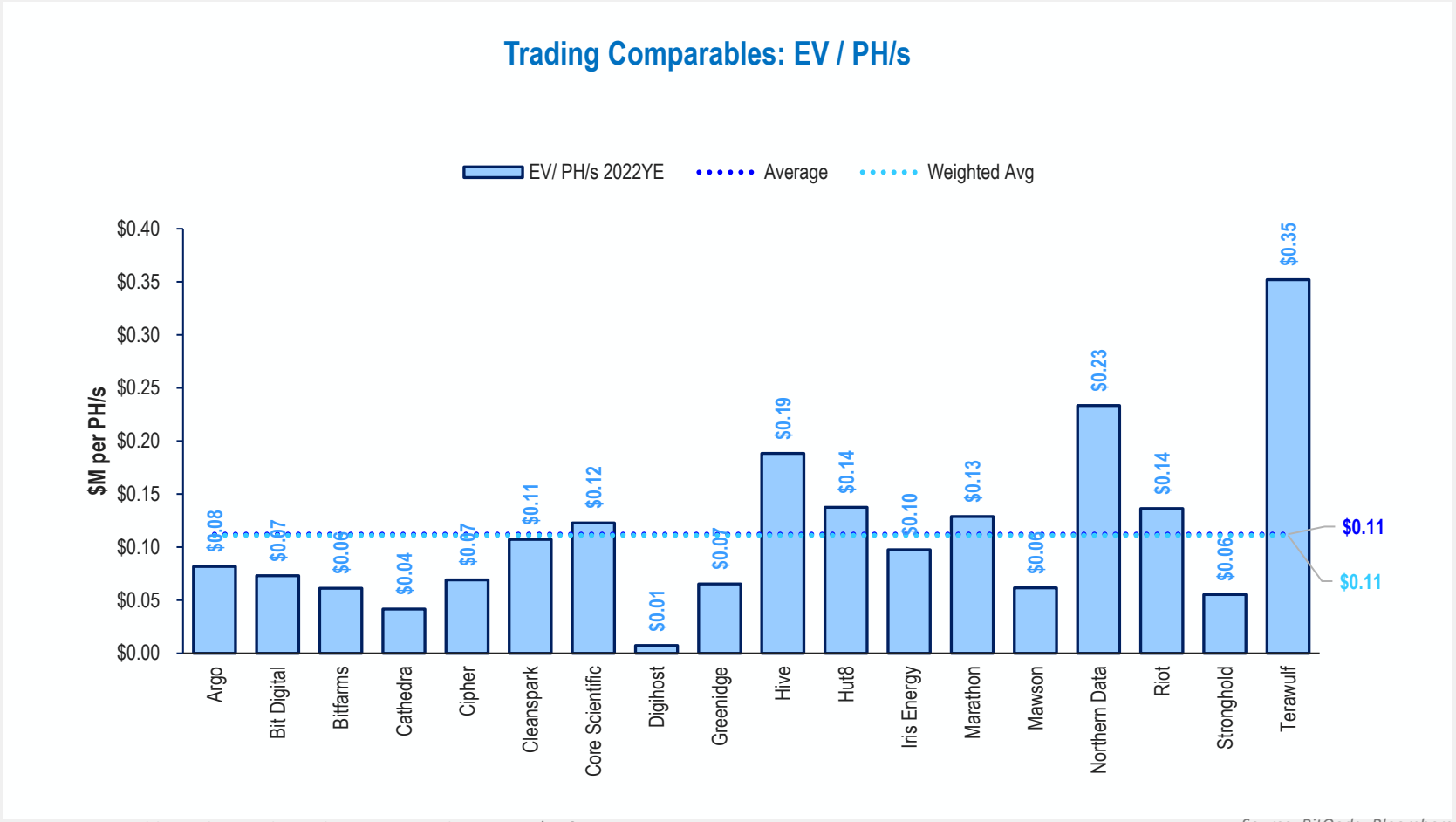


Figure: Comparable analysis: Adjusted Enterprise Value per PH/s of YE 2022 Capacity

Source: BitOoda, Bloomberg

Valuations are Higher
The More YE 2022 Hashrate Comes Online

- Markets give a premium to operational capacity
- The more year end 2022 capacity is already online, the higher the valuation
- This supports the notion that the market recognizes the drop off in Bitcoin production over time
- **Thus, the less growth is in the future, the higher the multiple; this is quite unlike most traditional equities**

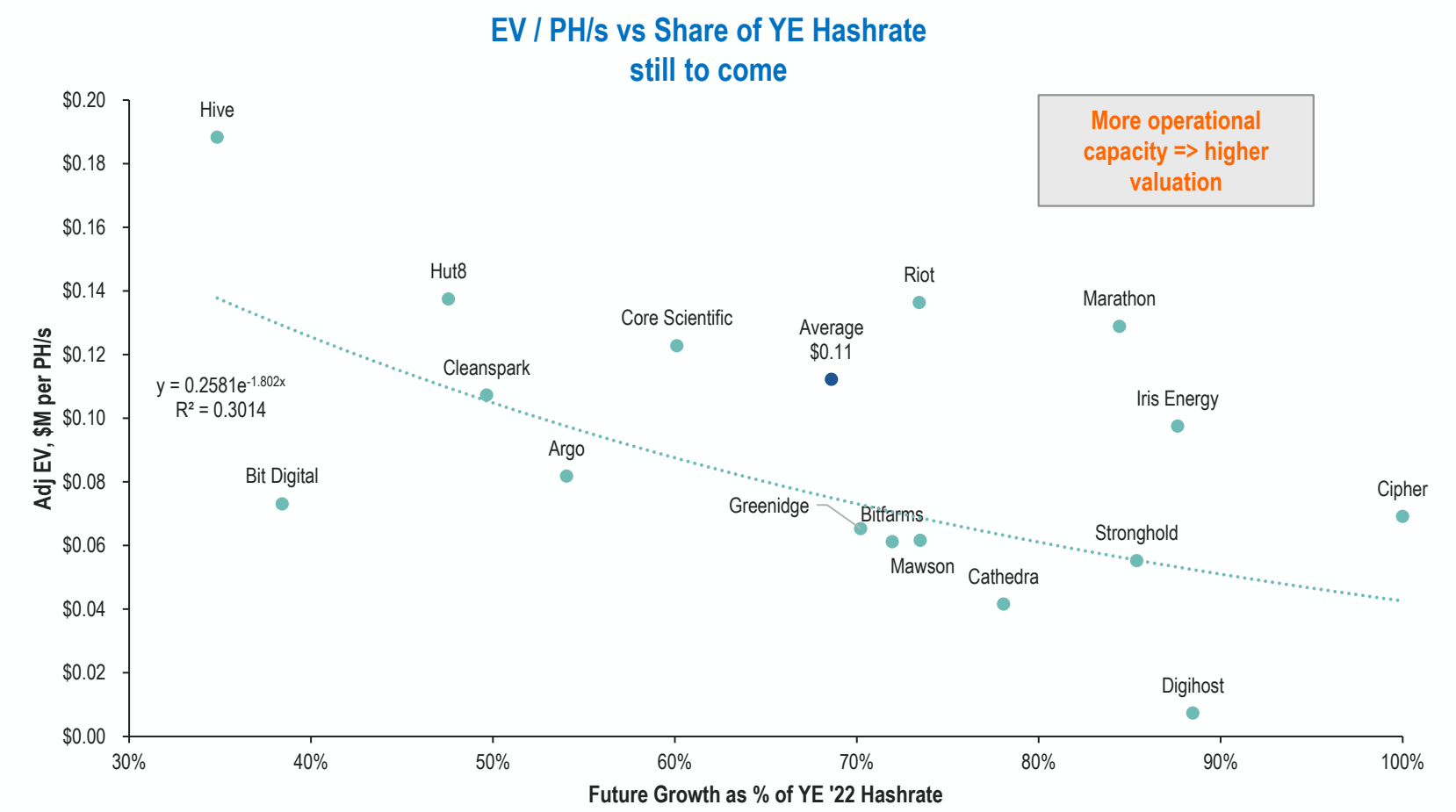


Figure: Public miner adjusted EV per PH/s vs. percentage of YE 22 Hashrate already operational
Note: Terawulf and Northern Data excluded as outliers

Source: BitOoda, Bloomberg

Valuation Differentials
Aided by Power / Hosting Costs

- Entities with the lowest direct operating cost, such as Greenidge and Riot, exhibit a premium to the group
- However, for most other companies, the relationship is weaker
- Hive, which has the highest valuation in the group, has a higher estimated all-in direct operating cost (based on BitOoda's estimates)
- Hive also has the largest share of YE 2022 Hashrate already operational, which may explain the higher valuation

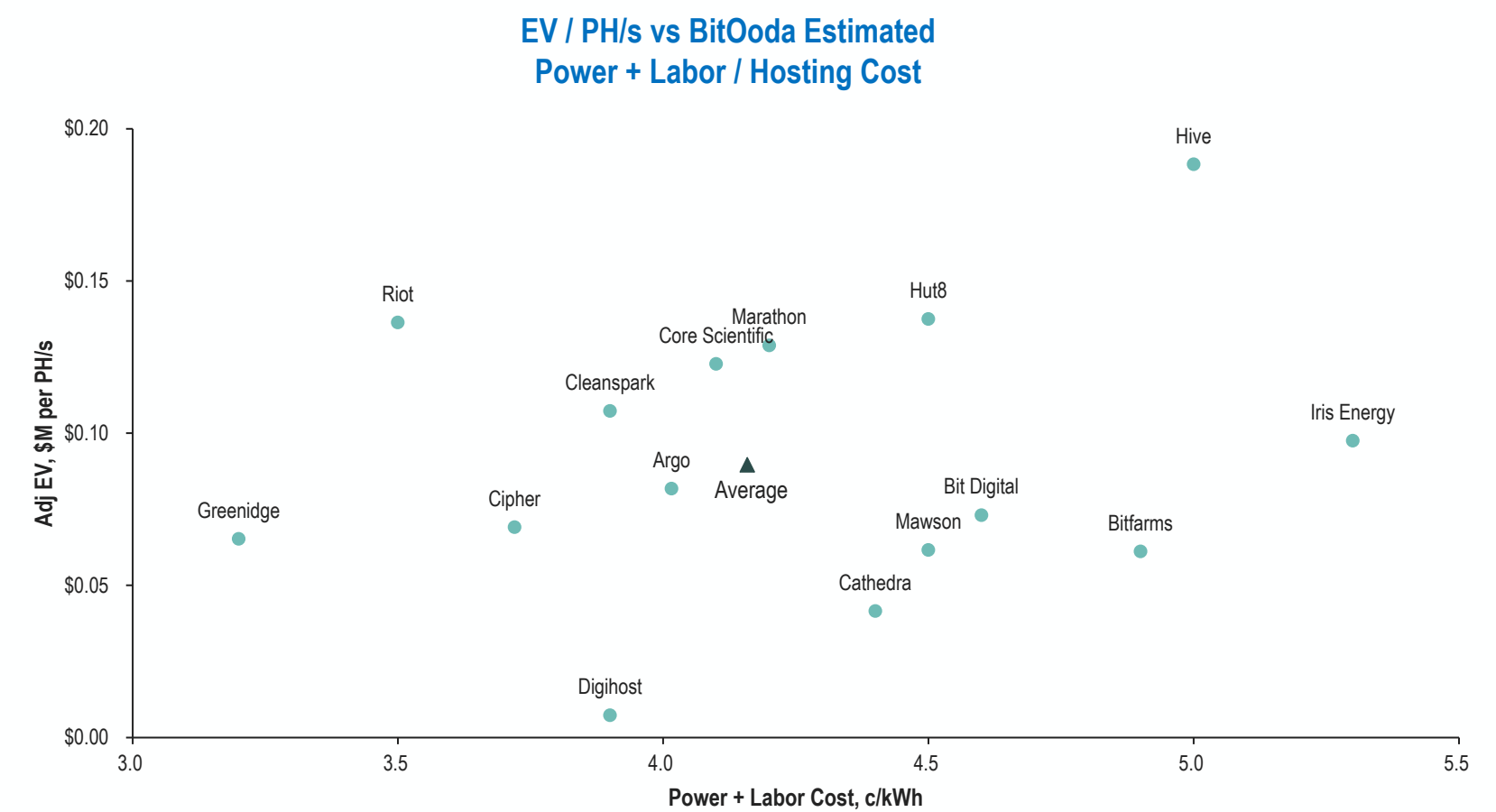


Figure: Adjusted EV per PH/s vs all in power + labor or hosting cost, cents per kWh
Note: 1. BitOoda estimates based on publicly available information; may not fully reflect actual all-in cost. 2. Excludes Terawulf and Northern Data

Source: BitOoda, Bloomberg

Select Financials

Few Analyst Estimates For Industry Aggregate Metrics

- The median trailing gross margin was 62%, with a mean 33% EBITDA margin
- As a group, the miners are expected to generate $3B in 2022 EBITDA on $4.7B in revenue, based on Bloomberg consensus
- This represents a reduction vs. last week's Bloomberg consensus estimates of $3.2B in 2022 EBITDA on $4.9B in revenue
- The group trades at an average 6.8x 2022E contribution (defined as cash cost of sales, adding back D&A to gross profit) and 3.7x Adj EV to 2022E EBITDA

Select Miner Financials

Name	Ticker	LTM Margins		Revenue			Gross Margin			EBITDA			D&A	EBIT			Contribution	Multiple of Contribution	Adj EV / 2022E EBITDA
		Gross	EBITDA	LTM	CY21E	CY22E	LTM	CY21E	CY22E	LTM	CY21E	CY22E	CY22E	LTM	CY21E	CY22E	CY22E		
Argo	ARBK				96.91	142.17		80.80	80.80		74.13	116.00	38.06		60.13	77.93	116.37	2.6x	2.6x
Bit Digital	BTBT				109.00	112.00		73.30	73.30						35.40	37.00		—	—
Bitfarms	BITF			121.22	172.00	244.00		69.80	69.80						86.60	112.00		—	—
Cathedra	CBIT CN	31.04	260.07	3.08			31.04			4.64				3.54				—	—
Cipher	CIFR			0.00							(5.00)	271.00		(4.47)				—	2.0x
Cleanspark	CLSK	75.76	(0.87)	88.42	45.55	182.50	75.76	73.20	73.20	1.16	(4.90)	88.50	36.05	(17.97)	(17.75)	52.45	69.39	6.8x	5.3x
Core Scientific	CORZ				519.33	1078.50		57.90	57.90		210.33	570.25	88.75		167.33	481.50	389.44	6.5x	4.4x
Digihost	DGHI																	—	—
Greenidge	GREE				125.00	231.00					49.70	124.00	42.70		(43.00)	81.30		—	2.5x
Hive	HIVE	67.29	120.30	240.03			67.29			260.21				214.38				—	—
Hut8	HUT	51.10	41.54	173.77	140.70	276.17	51.10	49.27	49.27	72.00	81.97	165.59	45.19	48.72	41.28	120.40	114.50	5.4x	3.7x
Iris Energy	IREN				74.82	338.50		82.50	82.50		43.87	242.83	43.43		29.13	199.40	105.16	6.0x	2.6x
Marathon	MARA	77.61	(172.35)	150.46	151.00	594.50	77.61	79.25	79.25	(61.62)	120.00	456.80	92.20	(85.08)	25.05	364.60	211.87	13.7x	6.3x
Mawson	MIGI													(47.70)				—	—
Northern Data	NB2 GY				231.05	807.52		66.30	66.30		117.81	602.78	218.47		36.60	384.32	371.65	2.9x	1.8x
Riot	RIOT	61.50	(10.10)	213.24	211.11	448.11	61.50	65.40	65.40	4.64	112.41	257.63	108.10	(22.36)	55.75	149.53	246.17	7.1x	6.8x
Stronghold	SDIG				35.24	268.60		4.00	4.00		8.25	184.40	45.86		(4.30)	138.54	47.27	10.4x	2.7x
Terawulf	WULF	33.76	(4.61)	16.30			33.76			(0.76)				(1.51)				—	—
Total				**1006.53**	**1911.70**	**4723.58**				**280.28**	**808.58**	**3079.77**	**758.81**	**87.55**	**472.22**	**2198.96**			
Average		**56.87**	**33.43**	**111.84**	**159.31**	**393.63**	**56.87**	**63.79**	**63.79**	**40.04**	**73.51**	**279.98**	**75.88**	**9.73**	**39.35**	**183.25**	**185.76**	**6.8x**	**3.7x**
Median		**61.50**	**(0.87)**	**121.22**	**132.85**	**272.39**	**61.50**	**69.80**	**69.80**	**4.64**	**74.13**	**242.83**	**45.52**	**(4.47)**	**36.00**	**129.47**	**116.37**	**6.5x**	**2.7x**

Figure: Select financial metrics – Bloomberg consensus revenue and EBITDA estimates
Note: Contribution is BitOoda estimate of gross profit less depreciation

Source: BitOoda, Bloomberg

Drawdowns From BTC Peak

Miners Underperforming Bitcoin

- Bitcoin is off 41% from its peak on November 10, 2021
- Over the same period, the S&P 500 is down 8% and the Nasdaq 15%
- Most miners have underperformed Bitcoin since November 2021 by an average additional 15%

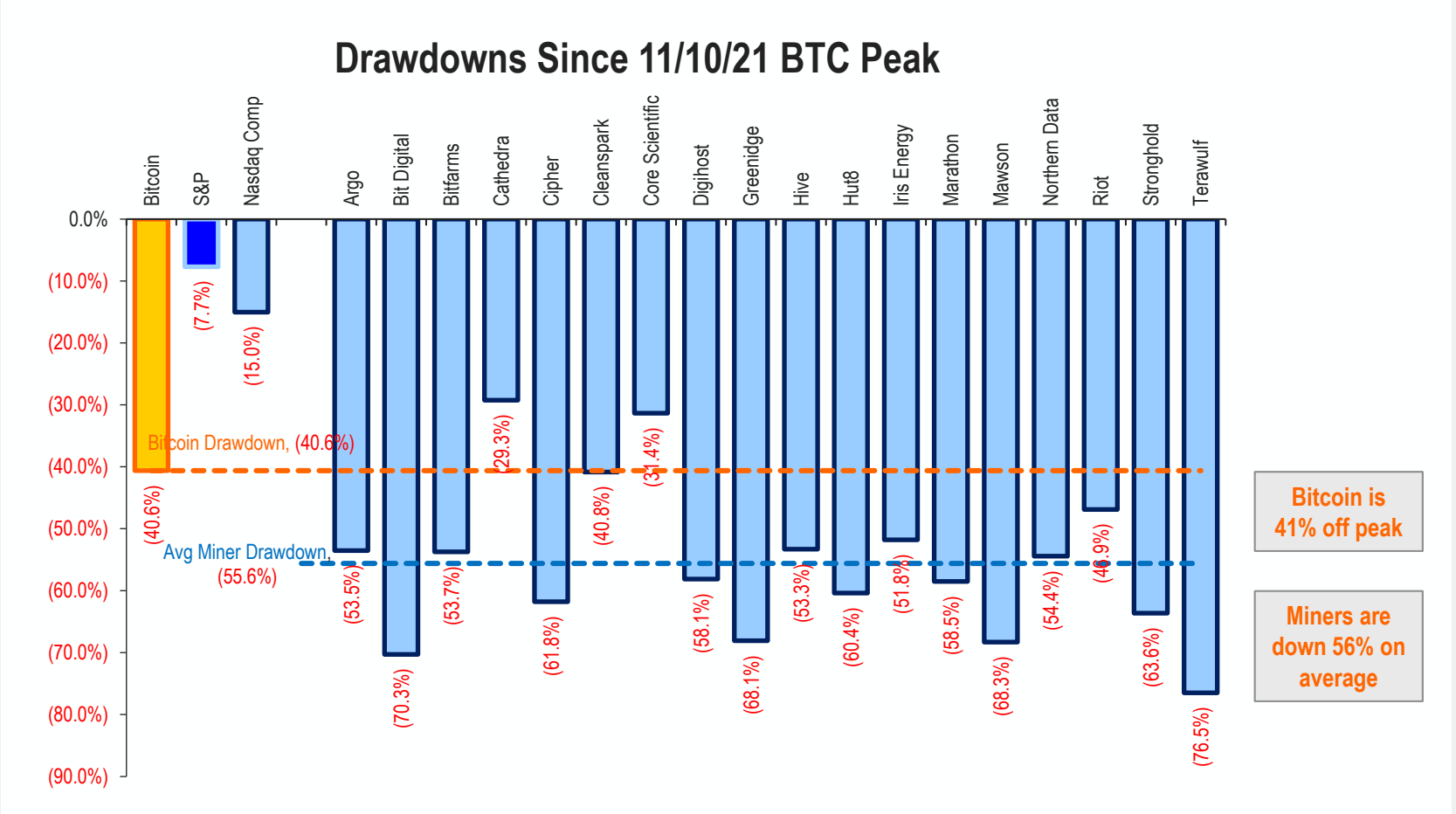


Figure: Bitcoin miner drawdowns
Notes: 1. Iris Energy's drawdown measured from 11/17/21

Source: BitOoda, Bloomberg

Beta & Correlation
Not All Miners Are Equal

- We expect most miners to exhibit a Beta > 1 relative to Bitcoin
- Bitcoin is off 41% from its November 2021 peak, Hashrate is up, and transaction fees are flattish, so miners should experience both falling revenue and margin compression
- Interestingly, although most miners have underperformed Bitcoin, both the beta to Bitcoin and correlation to Bitcoin show much more dispersion
- The correlation of Bitcoin to the S&P and Nasdaq is quite high, at 52% & 59%, respectively
- **The correlation to equities continues to pick up following a risk-on week**

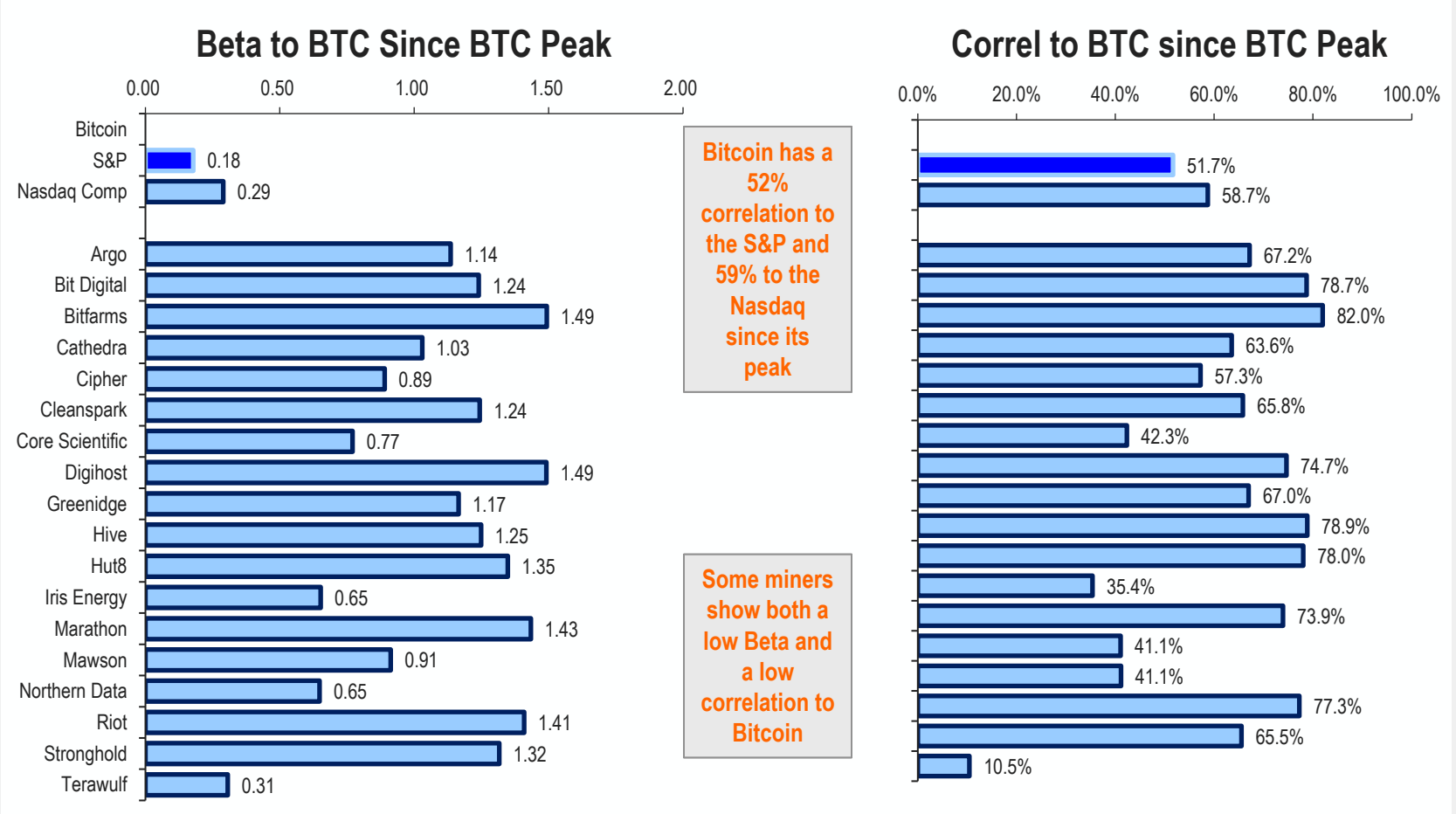


Figure: Bitcoin miner drawdowns
Note 1. Iris Energy's drawdown measured from 11/17/21

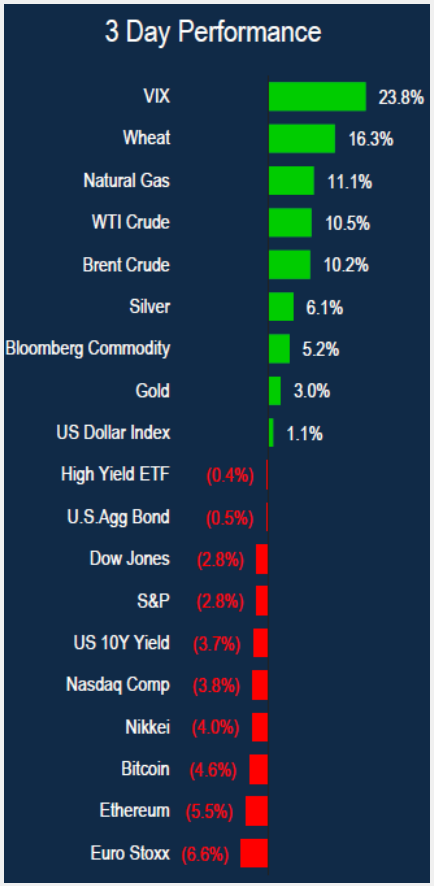
Source: BitOoda, Bloomberg

Bitcoin and Broader Markets

Macro Markets:
Risk On

- Markets have been generally risk on over the past week
- The 10 Year US Treasury is now yielding 2.24% following the first Fed hike since 2018
- Ethereum has been the best performing asset in the group, followed by the Nasdaq Composite
- BTC trails the S&P for the week, while the DXY dollar index, Gold and the VIX round out the worst performing assets

3D Performance as of 2/23



7D Performance as of 3/21

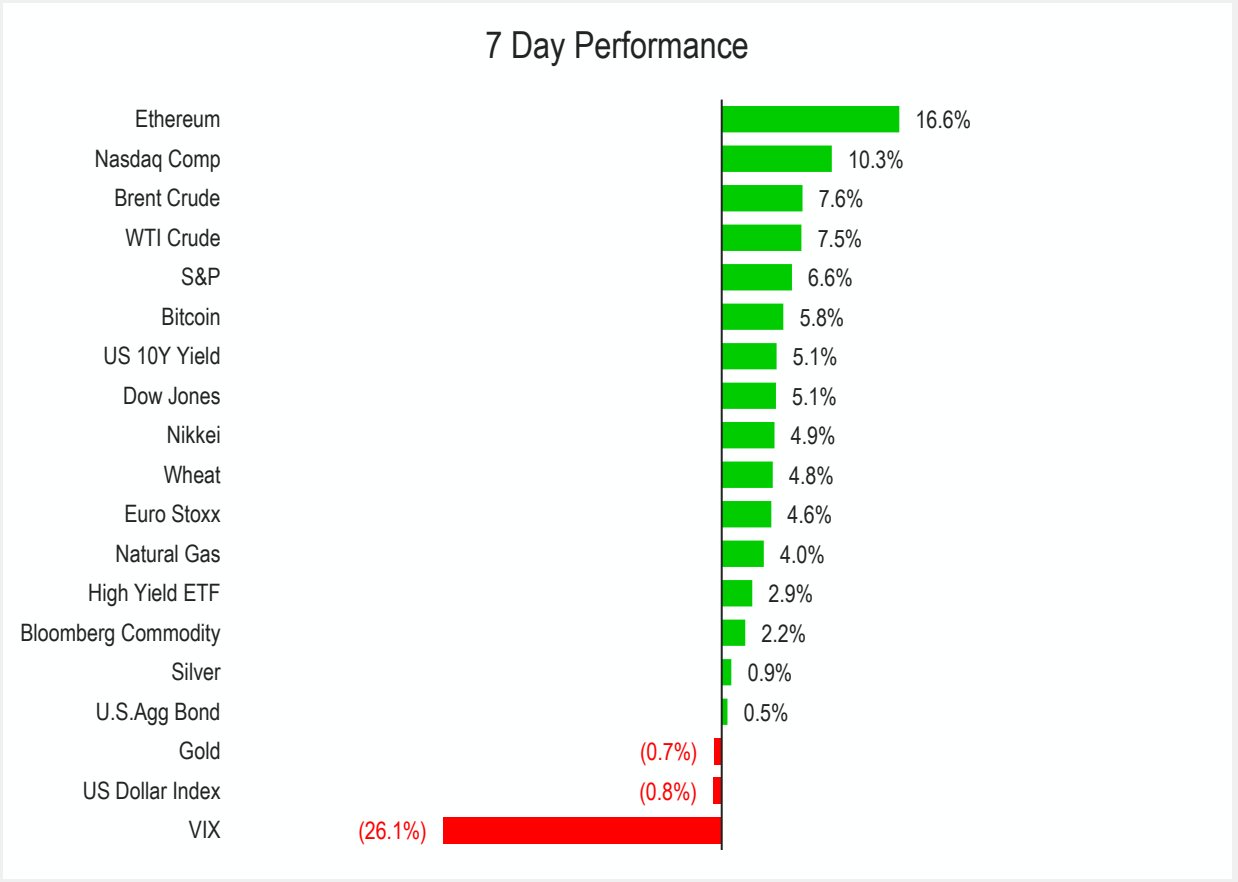


Figure: Macro Indicators: Returns over 7 days, and 3 day returns as of 2/23

Source: BitOoda, Bloomberg

Implied BTC Volatility Drops
Now 14% Below Realized

- Realized Bitcoin volatility (30-day annualized) consistently comes in under 100% moneyness implied vol for the generic 1st CME contract
- However, this recently flipped to realized exceeding implied volatility
- Overall, both volatilities came down WoW
- Currently, 100% moneyness implied volatility is 60.2% (vs. 69.6% a week ago), compared with 74.5% (71% a week ago) for realized volatility
- Realized volatility is 14% points above implied volatility, vs. 1.4% last week

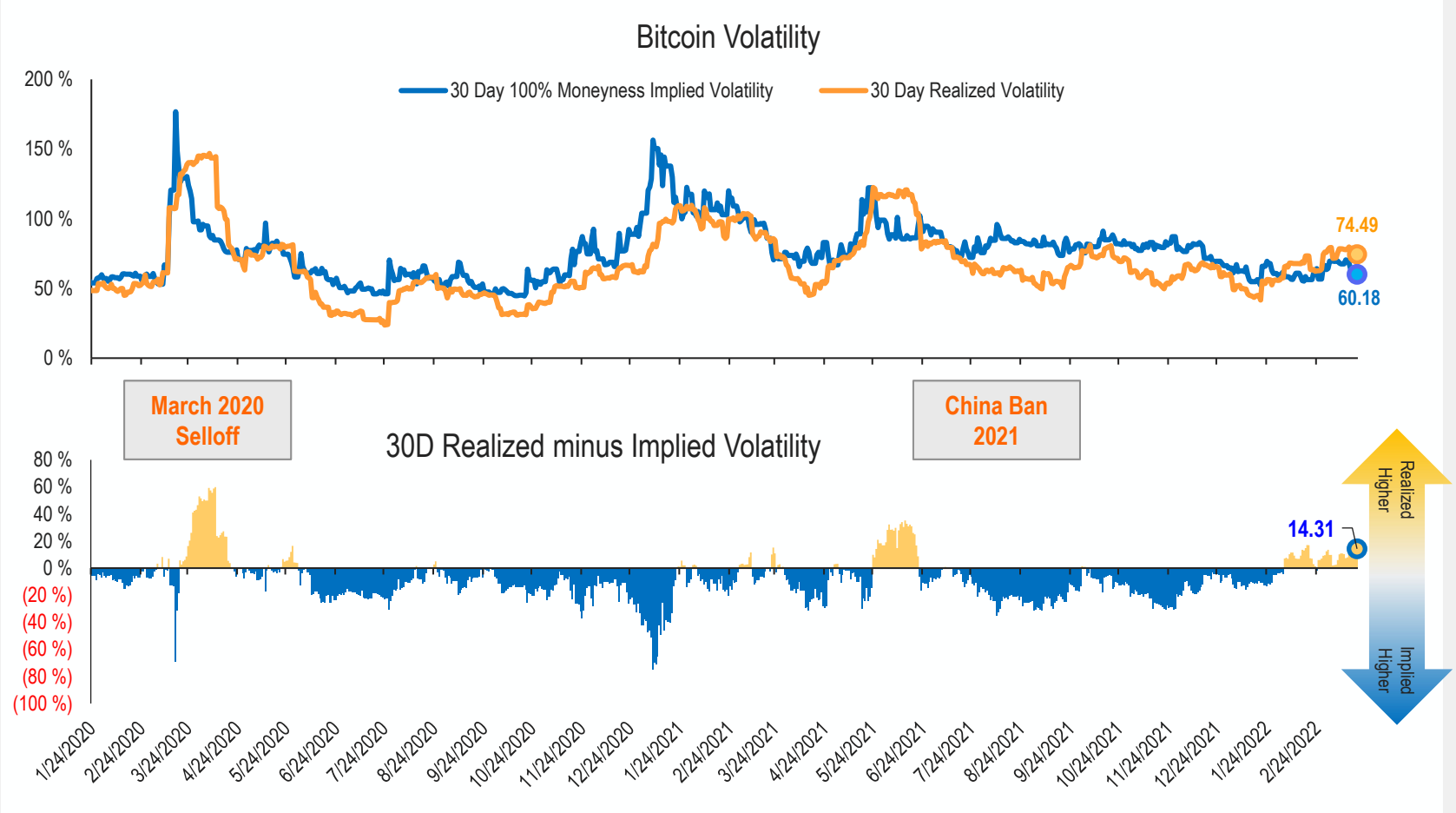


Figure: Trailing 2-year Bitcoin annualized volatility based on 30-day trailing daily returns of XBTUSD Curncy and 100% Moneyness Implied Volatility for BTC1 Curncy

Source: Bloomberg, BitOoda

When the Nasdaq Sneezes
Bitcoin Catches a Cold

- As shown below, when the Nasdaq performance is in the bottom quartile of its range (since BTC's peak), Bitcoin's return is usually also in the bottom quartile
- This relationship holds in the second quartile of Nasdaq performance as well
- However, the relationship is much weaker when the Nasdaq is doing well
- Later in this report, we also show performance by decile since 1/1/2020

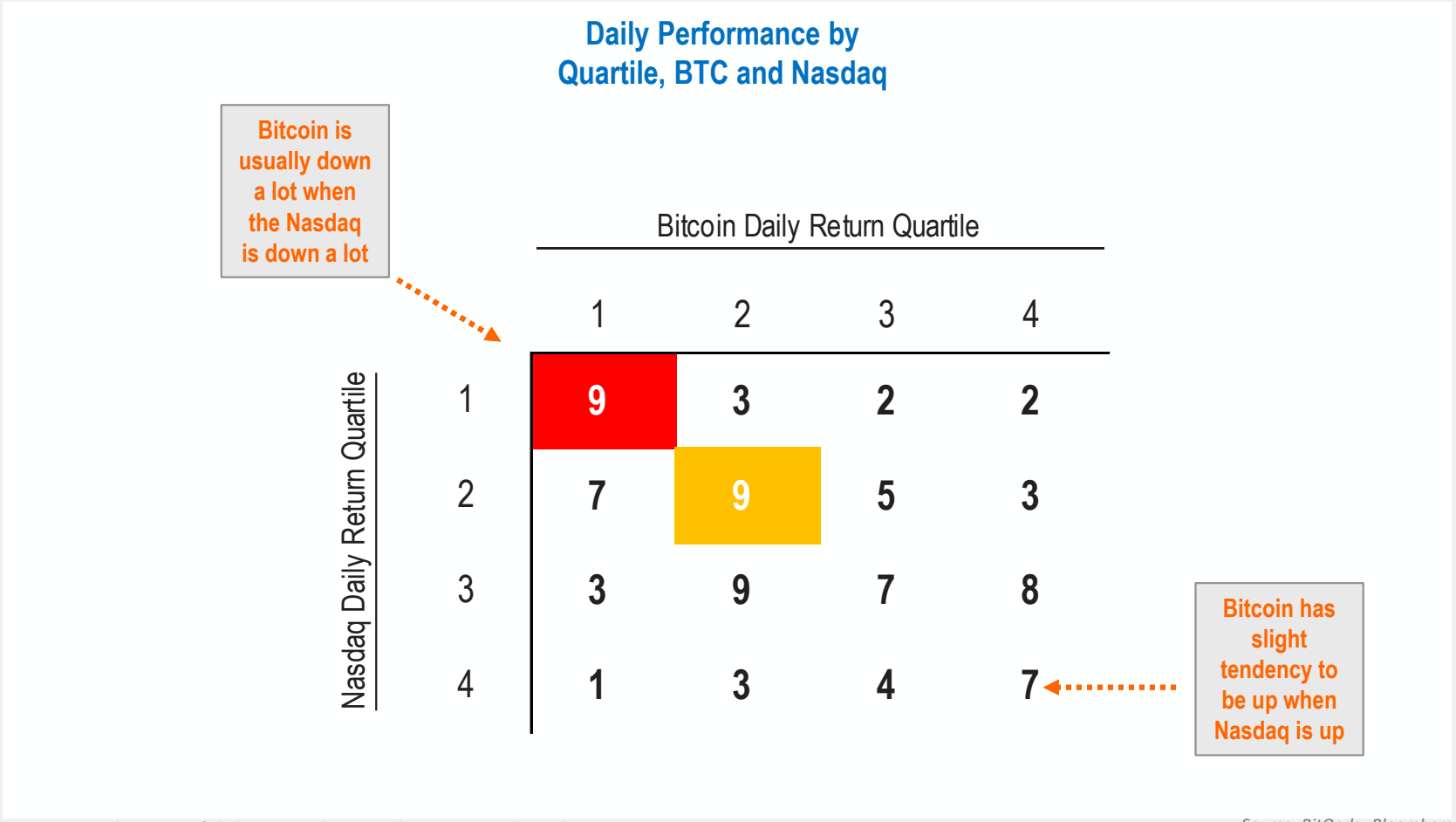


Figure: Sample count of daily returns by quartile, Bitcoin and Nasdaq
Note Since 11/10/21

Source: BitOoda, Bloomberg

59% BTC / Nasdaq Correlation
Stronger when Nasdaq Weak

- The scatter plot below shows the daily performance of Bitcoin against the Nasdaq, grouped by quartile of Nasdaq returns, since BTC's peak on 11/10/21
- We see that Bitcoin returns cluster on the negative side when the Nasdaq is weakest
- Further, the worst daily returns coincide with some of the worst Nasdaq returns

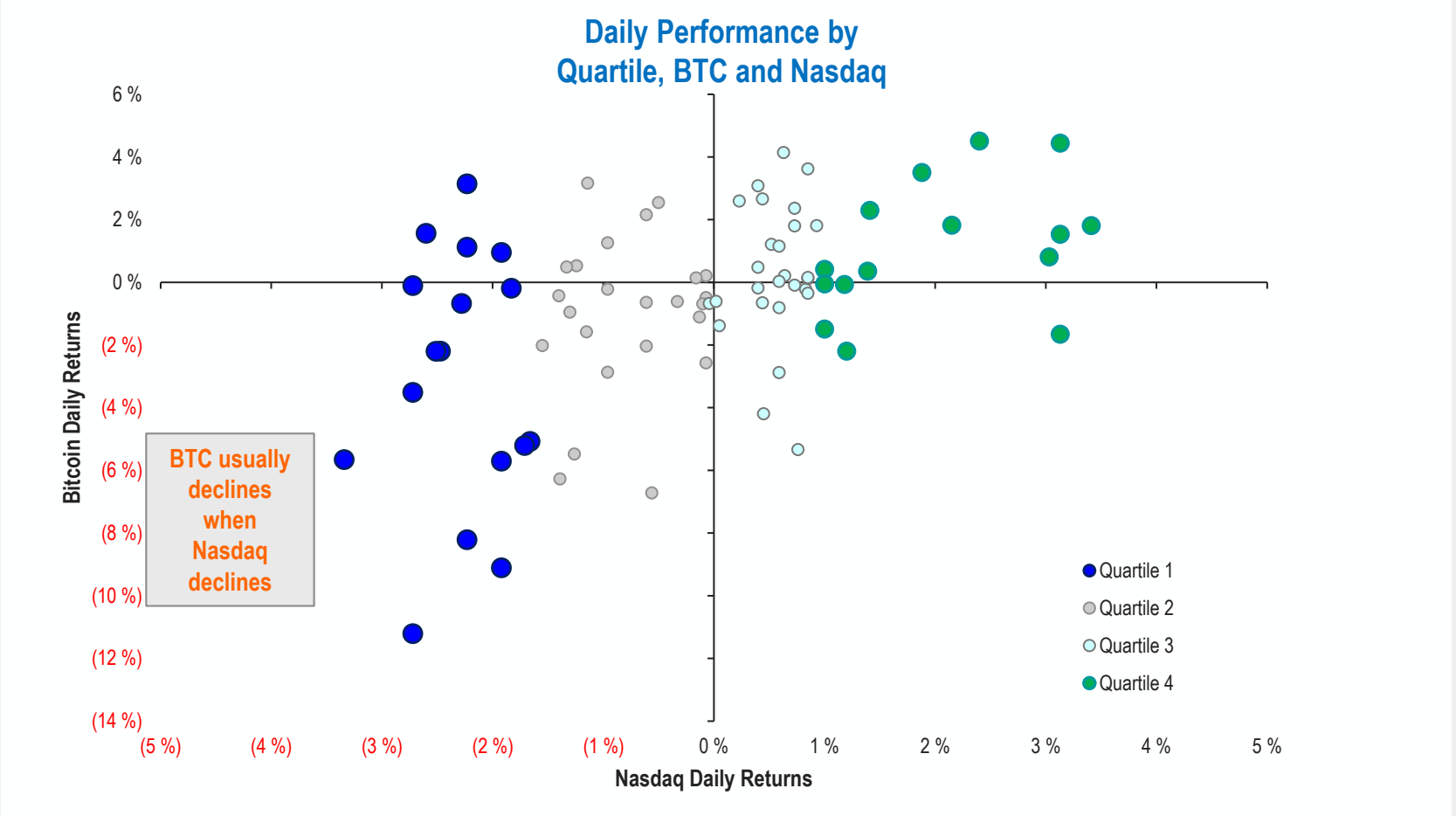
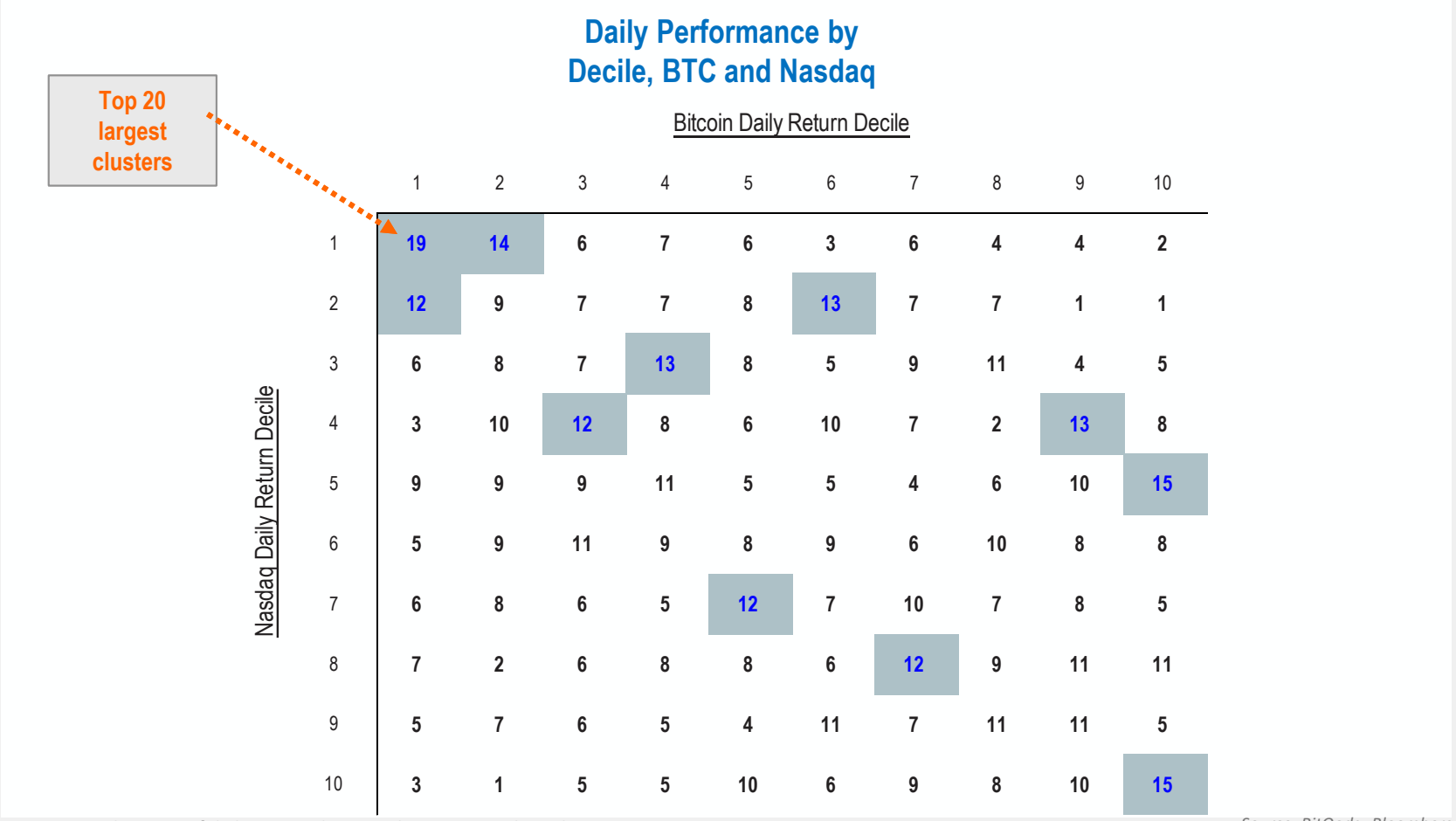


Figure: Bitcoin miner drawdowns
Note Lowest quartile is weakest 25% of daily returns

Source: BitOoda, Bloomberg

Worst Decile of BTC Returns
Most Likely When Nasdaq Weakest

- BTC is likely to perform poorly when the Nasdaq is underperforming, based on performance data since Jan 2020
- With the larger sample size, we looked at deciles of daily returns for both Bitcoin and the Nasdaq
- The single largest sample frequency is when both Bitcoin and the Nasdaq have returns in the bottom decile – 20 instances
- This relationship holds in the top decile of Nasdaq performance as well



Nasdaq Daily Return Decile	1	2	3	4	5	6	7	8	9	10
1	**19**	**14**	6	7	6	3	6	4	4	2
2	**12**	9	7	7	8	**13**	7	7	1	1
3	6	8	7	**13**	8	5	9	11	4	5
4	3	10	**12**	8	6	10	7	2	**13**	8
5	9	9	9	11	5	5	4	6	10	**15**
6	5	9	11	9	8	9	6	10	8	8
7	6	8	6	5	**12**	7	10	7	8	5
8	7	2	6	8	8	6	**12**	9	11	11
9	5	7	6	5	4	11	7	11	11	5
10	3	1	5	5	10	6	9	8	10	**15**

Figure: Sample count of daily returns by quartile, Bitcoin and Nasdaq
Note Since 1/1/20

Source: BitOoda, Bloomberg

Long Term BTC / Nasdaq Correlation

- The scatter plot below shows the daily performance of Bitcoin against the Nasdaq, grouped by the top / bottom decile of Nasdaq returns, since 1/1/2020
- We see that Bitcoin returns cluster on the negative side when the Nasdaq is weakest
- Equally, there is a visible relationship when the Nasdaq is strongly positive
- Further, the worst daily returns coincide with some of the worst Nasdaq returns
- The overall correlation is close to zero ($R^2 = 0.08$), making Bitcoin an "uncorrelated asset", but the relationship is stronger at the extremes – so it is correlated when investors need it to be uncorrelated

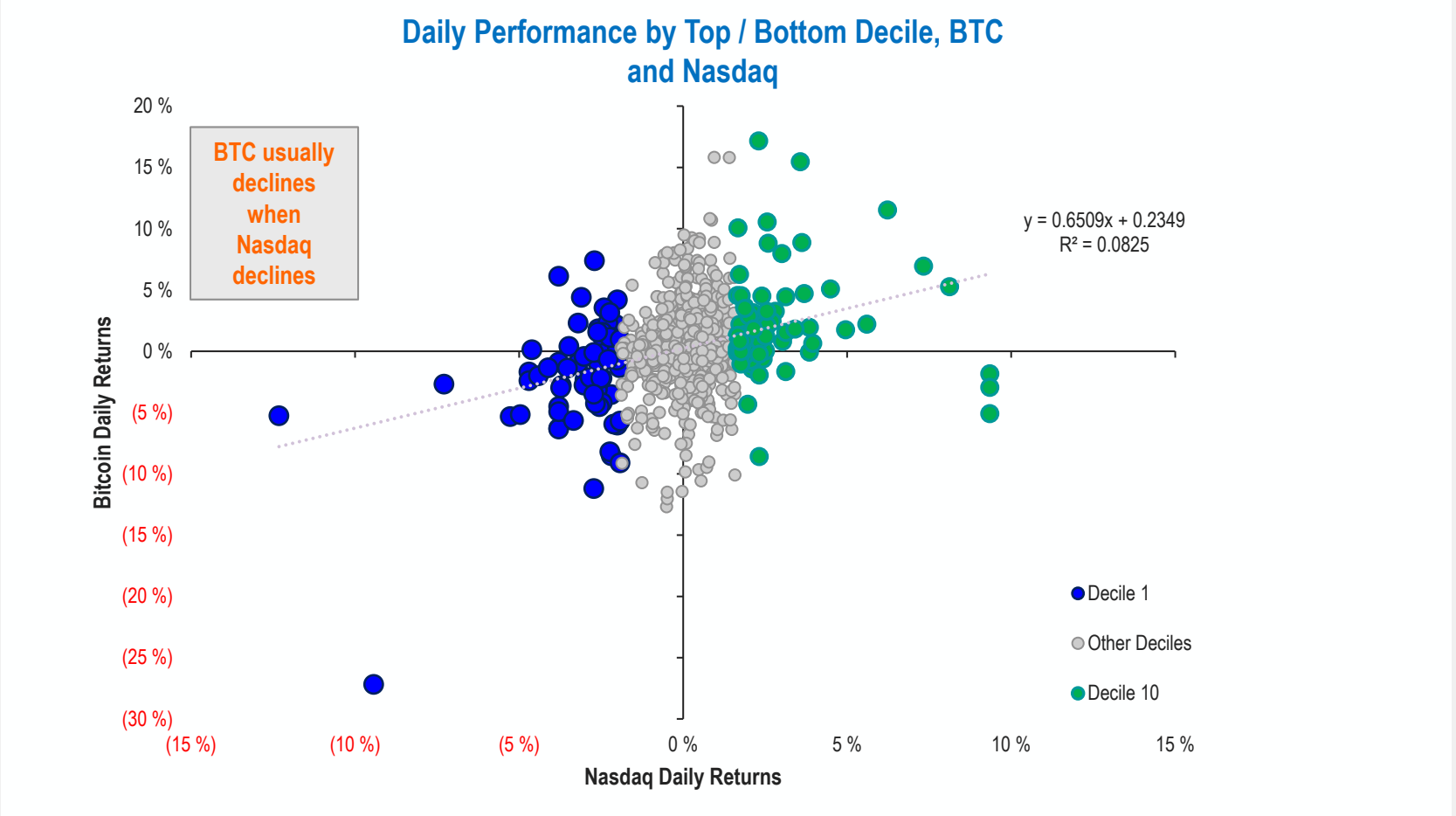


Figure: Bitcoin miner drawdowns
Note Lowest decile is weakest 10% of daily returns, since 1/1/2020

Source: BitOoda, Bloomberg

Bitcoin Drawdowns

Much Deeper and Longer than Equity

- Bitcoin is in its fourth major drawdown since 2014
- Over the same period, equities have exhibited frequent small drawdowns, but have exceeded 10% into correction territory only a handful of times
- There have been only two short-lived bear markets in equities since 2014, including early in the pandemic
- Bitcoin is only intermittently within 10-20% of all time highs

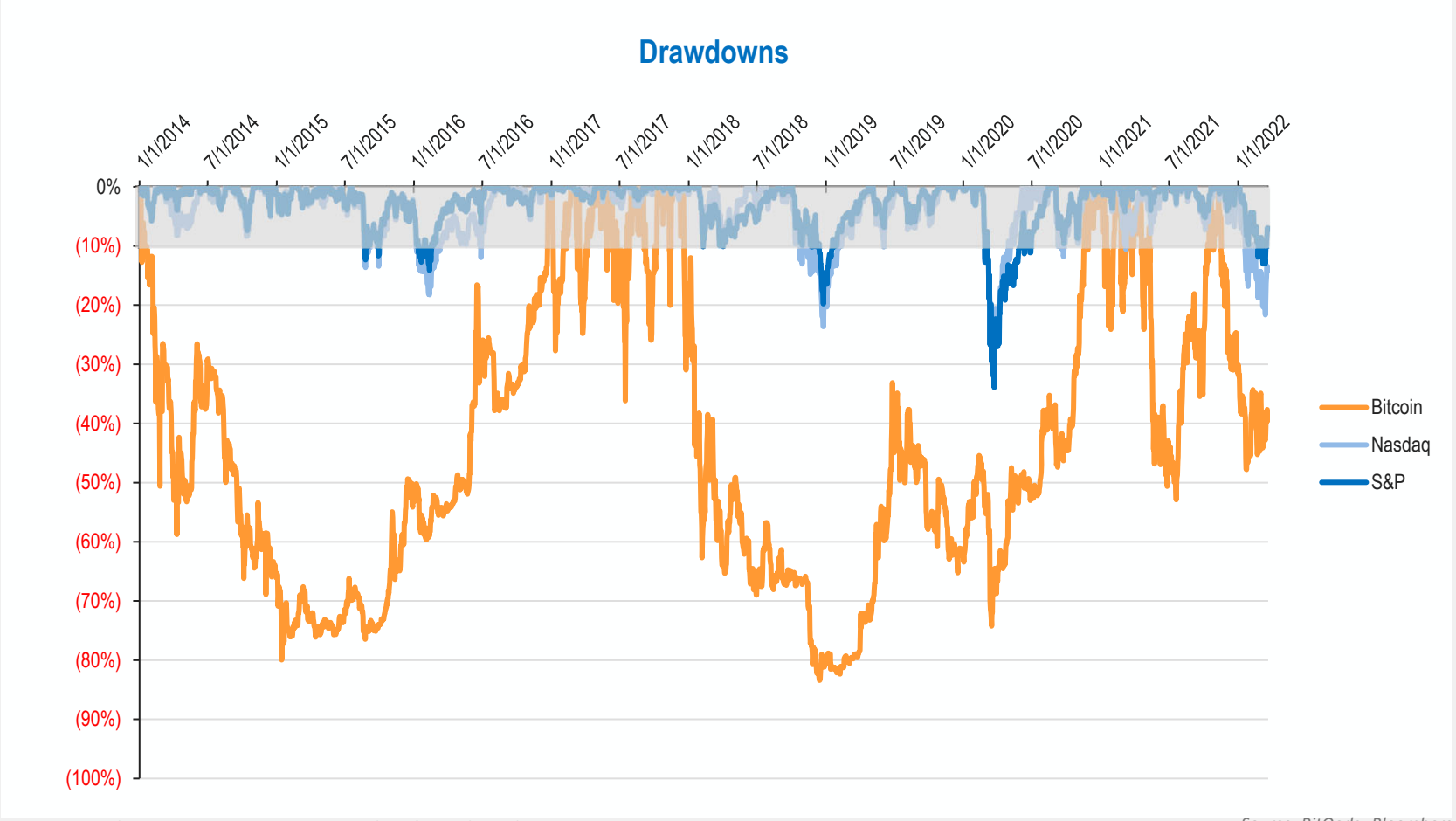


Figure: Drawdown comparisons: Bitcoin vs the S&P and Nasdaq Composite
Since 1/1/2014

Source: BitOoda, Bloomberg

Institutional Fund Flows

Select Fund Analysis

GBTC is Largest; Most are Small

- GBTC, an ETP, has the largest Assets Under Management (AUM) in our select group below, representing $19B of the $25B Market Cap for the group
- Some of the other large-ish funds with crypto exposure include ARKW, BITO, BLOK and BITW
- Of these, GBTC appears not to have raised any capital in recent times
- **Please let us know of any funds you would like to see included in the data**

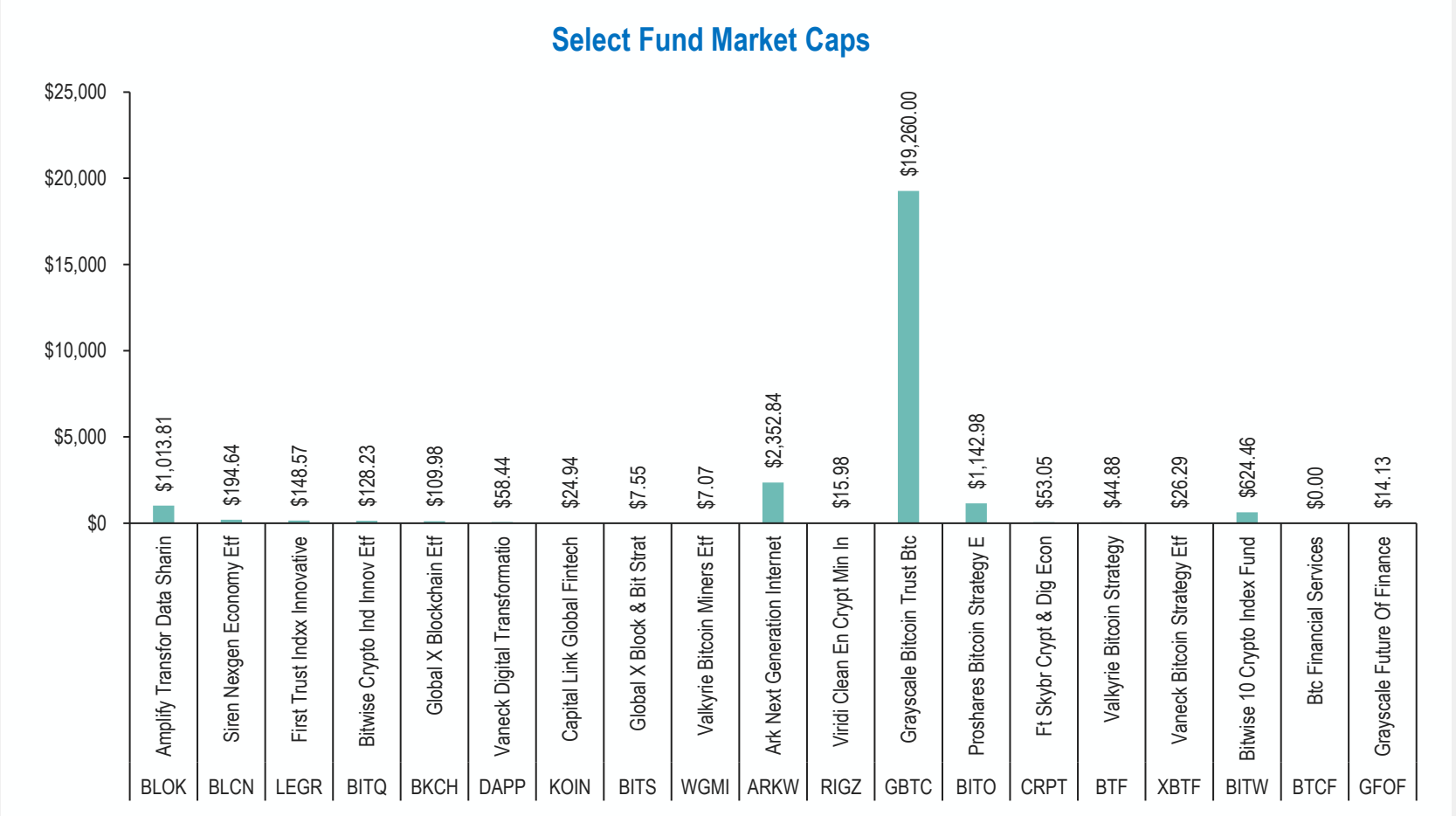


Figure: Select fund markets caps
As of 2/28/2022

Source: BitOoda, Bloomberg

Trailing 12M Cumulative Flows
$278mm Net Inflows

- The select fund group saw consistent outflows for much of the last year, offset by inflows into BITO upon launch in October.
- Overall, our selected funds show inflows of $278mm over the trailing 12 months
- A week ago, the number stood at $303mm of outflows, but the decline is a dropping off of outflows from a year ago; the past week has seen a net inflow of about $73mm

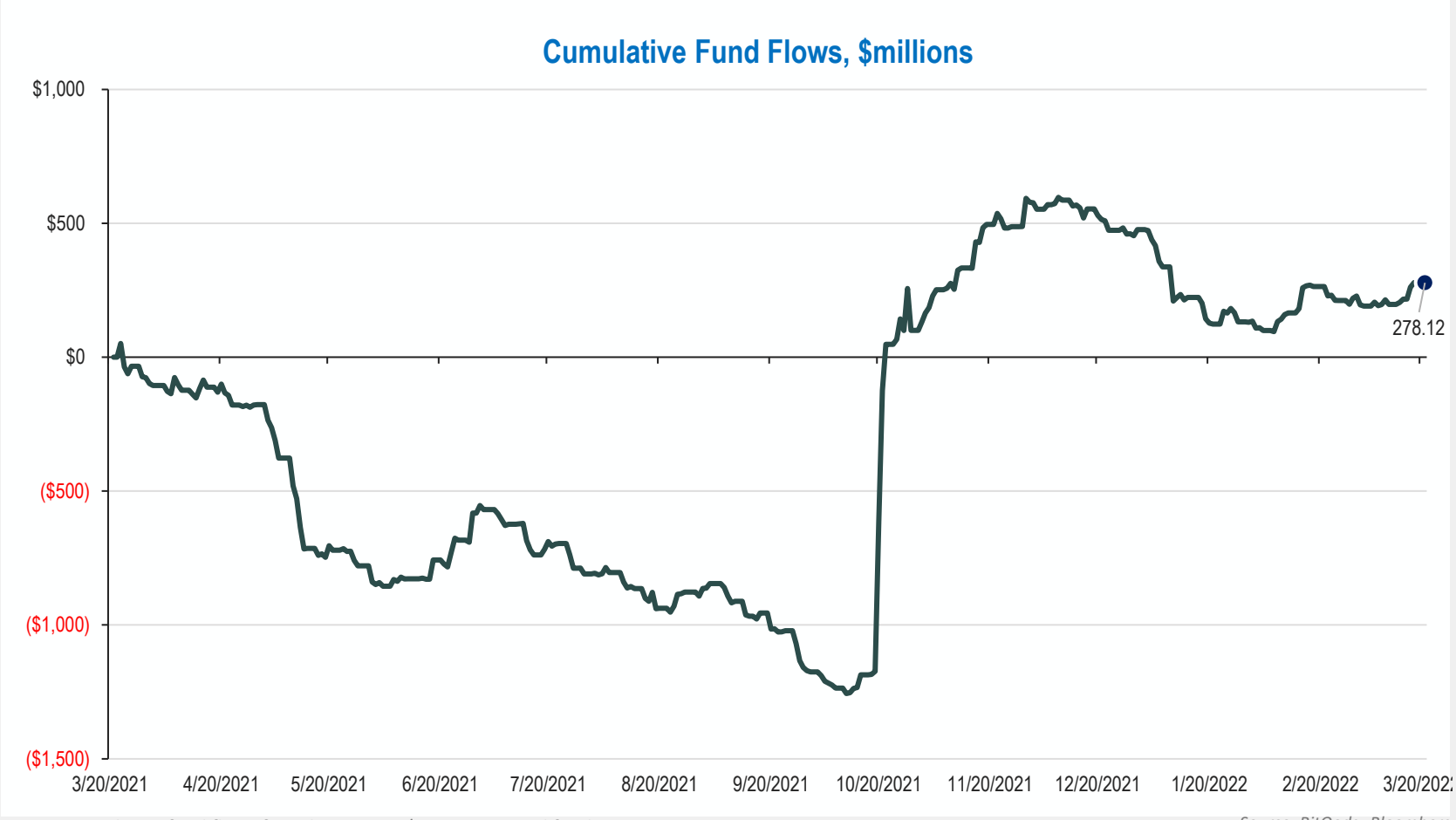


Figure: Cumulative fund flows for select crypto / crypto exposed funds
Trailing one year

Source: BitOoda, Bloomberg

Select Flows

BITO, BLOK Inflows; ARKW Outflows

- Over the past year, ARKW – which is not just exposed to crypto but to Web 3 / tech innovation more broadly – has seen $2.6 billion of outflows
- Over the same period, BITO has seen $1.73B of inflows, with BLOK receiving $417mm and other selected funds receiving $715mm of inflows

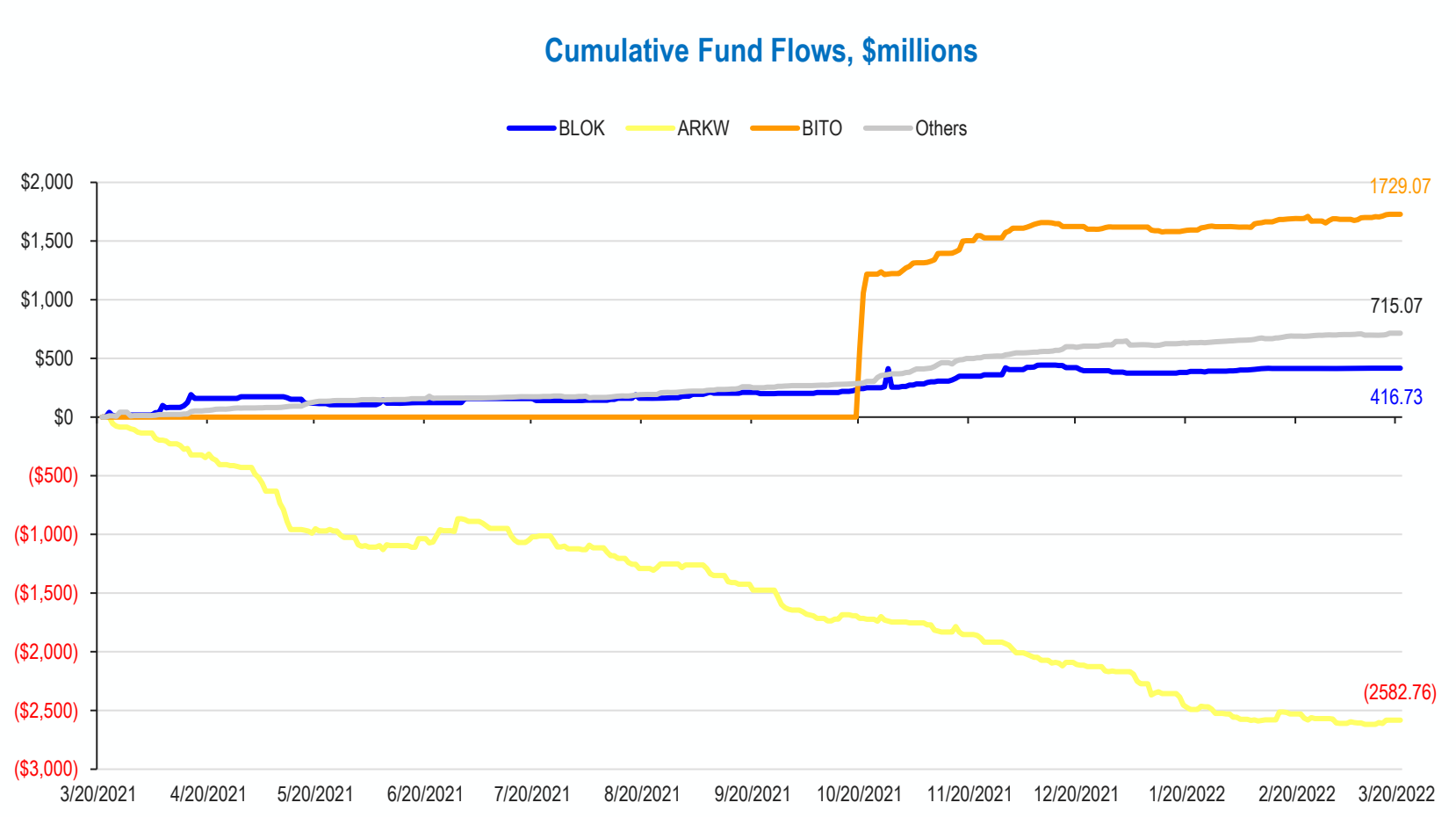


Figure: Cumulative fund flows for select crypto / crypto exposed funds
Trailing one year

Source: BitOoda, Bloomberg

YTD Daily Fund Flows

$81mm Inflows in Past Week Alone; $198mm Outflows YTD

- Since the beginning of the year, the fund group saw $198mm in redemptions
- The group saw $81mm of inflows last week

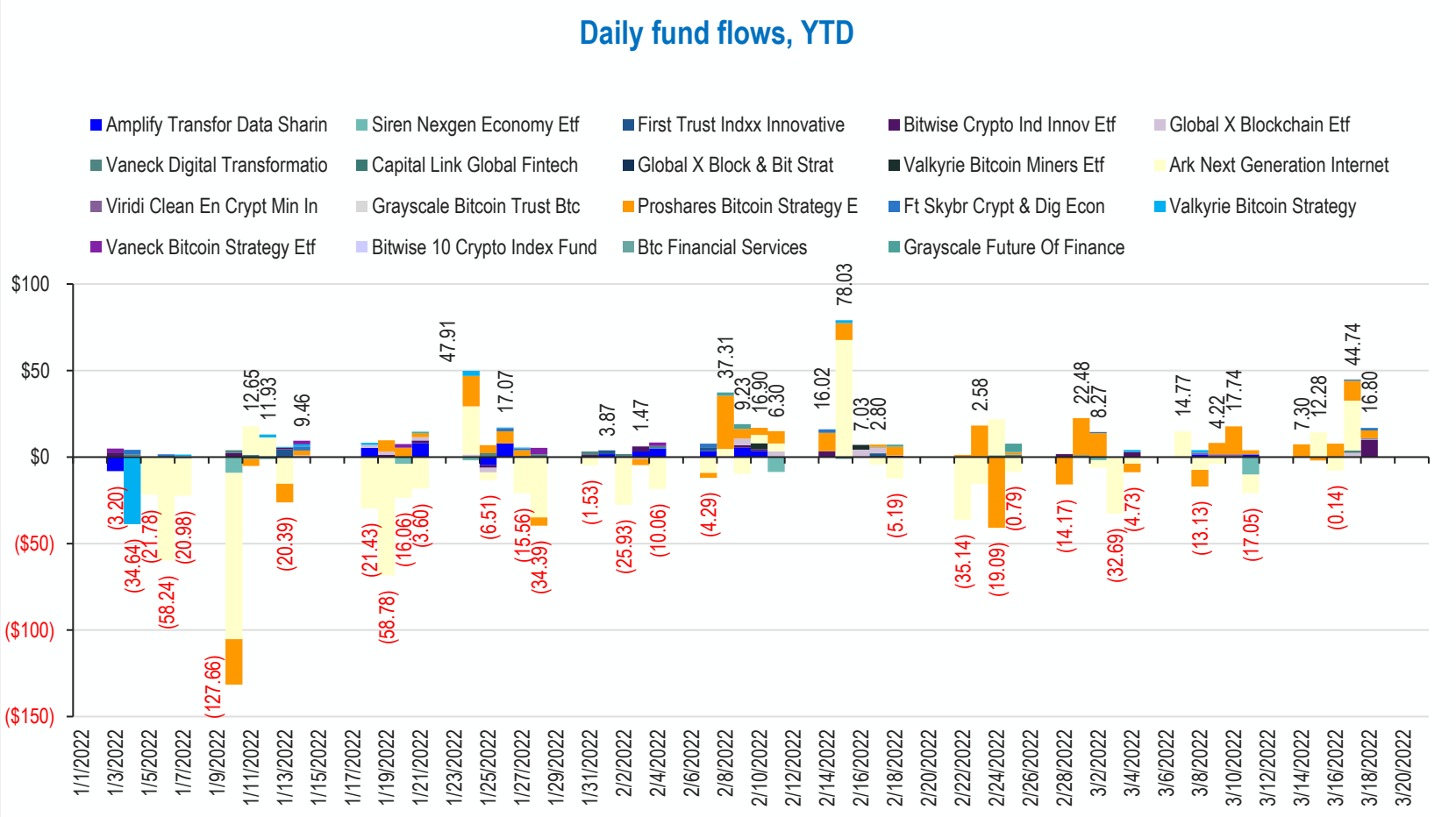


Figure: Daily fund flows
Since 1/1/2022

Source: BitOoda, Bloomberg

ProShares Futures ETF BITO

Modest, Expected Underperformance

- The ProShares ETF BITO currently has a market cap of $1141 million
- The ETF has underperformed Bitcoin by 2.6%, declining by 38.5% since launch vs. a 35.9% decline in the price of BTC in the same timeframe
- This is expected given the cost of rolling the futures contracts each month

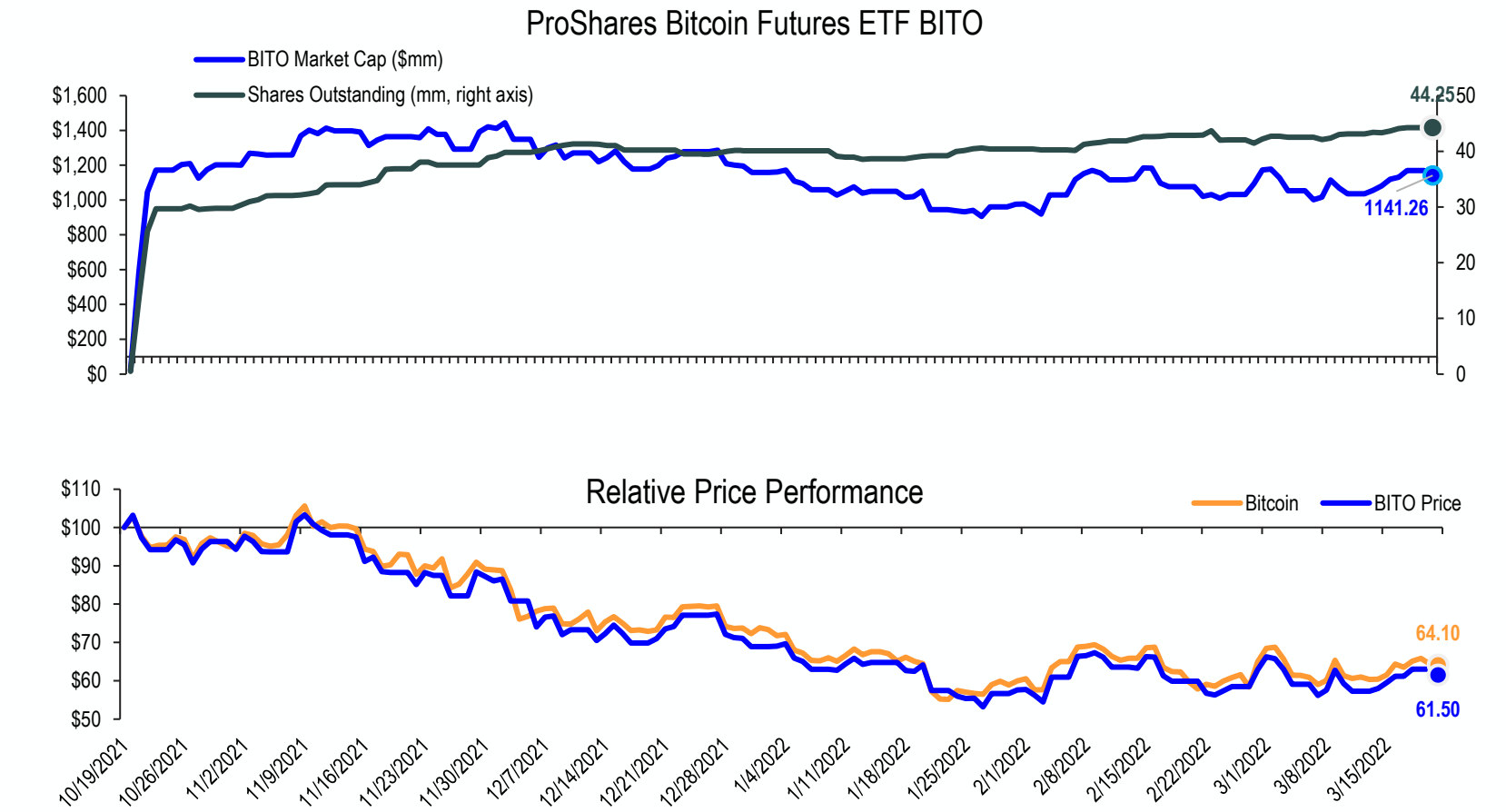


Figure: ProShares Bitcoin Strategy Futures ETF market cap and price performance compared to Bitcoin

Source: BitOoda, Bloomberg

ProShares Futures ETF BITO

$29mm Net Inflows in Past Week

- The ProShares ETF BITO saw ~$29mm of inflows last week
- This was the second consecutive week of inflows

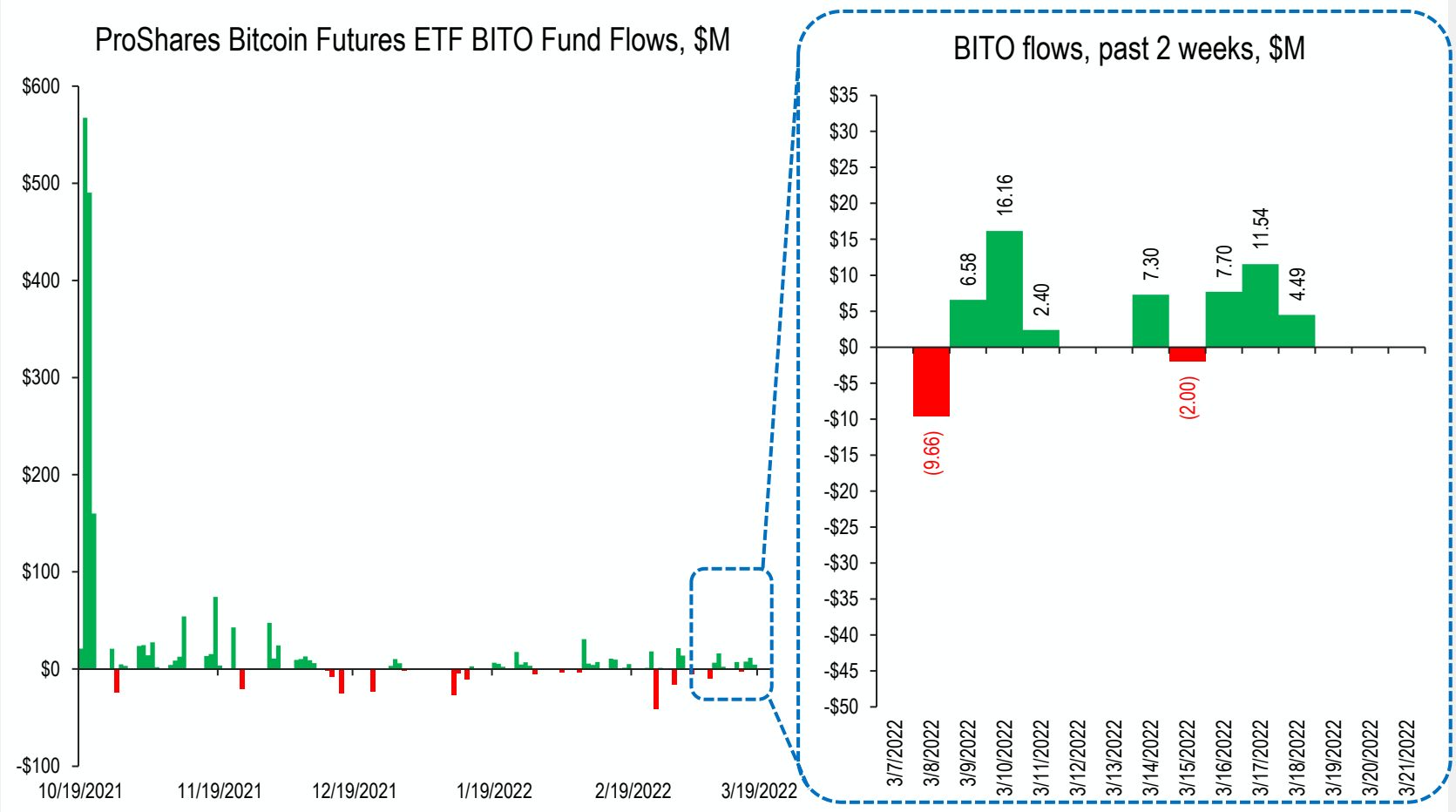


Figure: ProShares Bitcoin Strategy Futures ETF market cap and price performance compared to Bitcoin

Source: BitOoda, Bloomberg

CME Futures

Futures Curve Flat through June

Open Interest Up 11% WoW

- The futures curve is flat through June
- Contango beyond, but without meaningful open interest or change in open interest
- Overall CME open interest gained 11% vs. last week and 14.5% vs. two weeks ago to 11,053 lots

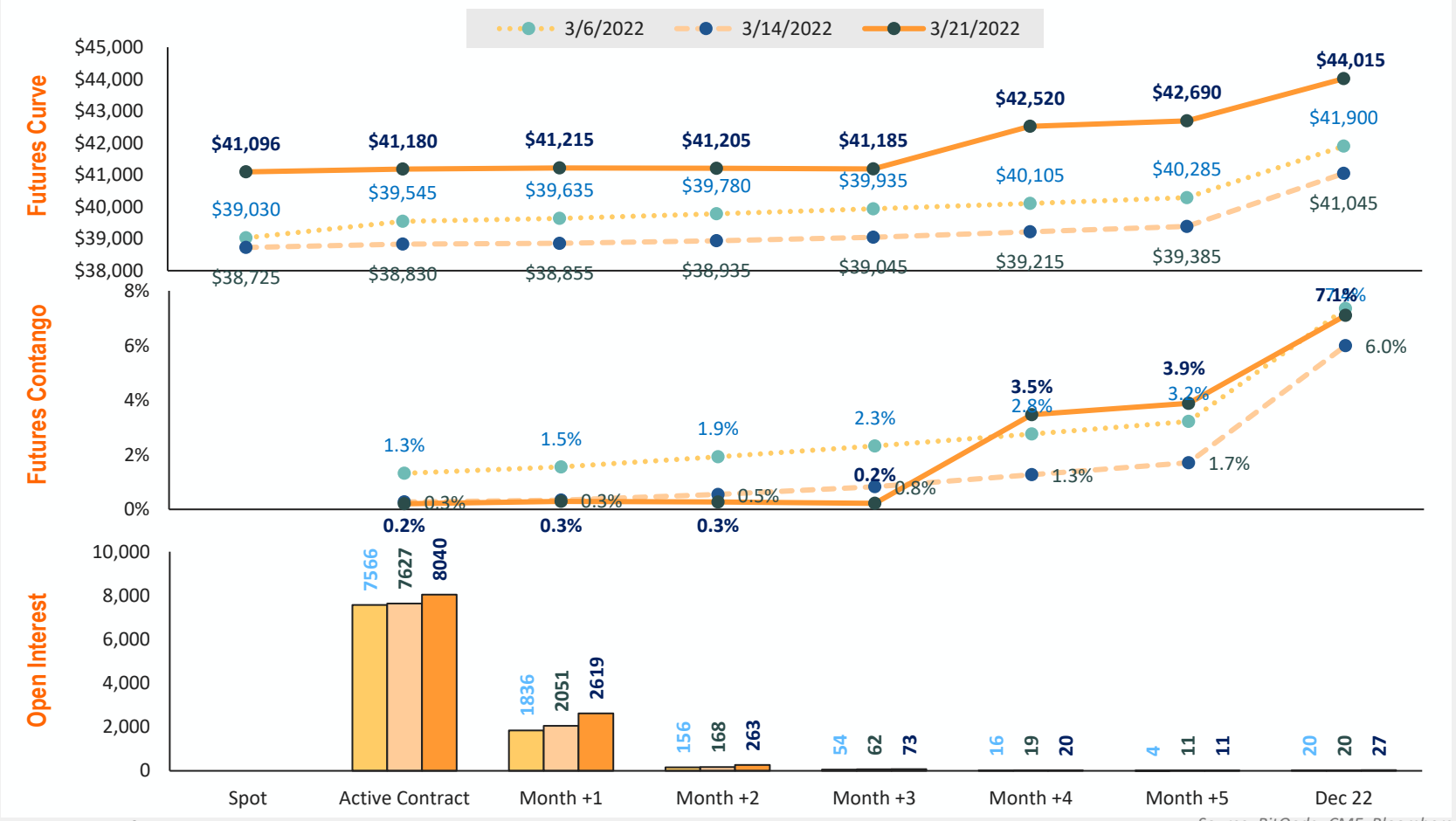


Figure: Bitcoin futures metrics

Source: BitOoda, CME, Bloomberg

CME Commitment of Traders

3/15 Open Interest Rose Broadly

- The CME Bitcoin Commitment of Traders report shows that open interest increased over the week to 3/15/22
- Data shows 10,198 lots on 3/15 compared with 9,591 lots on 3/8
- Broad based increase in open interest, with the exceptions being Dealers and Commercial players

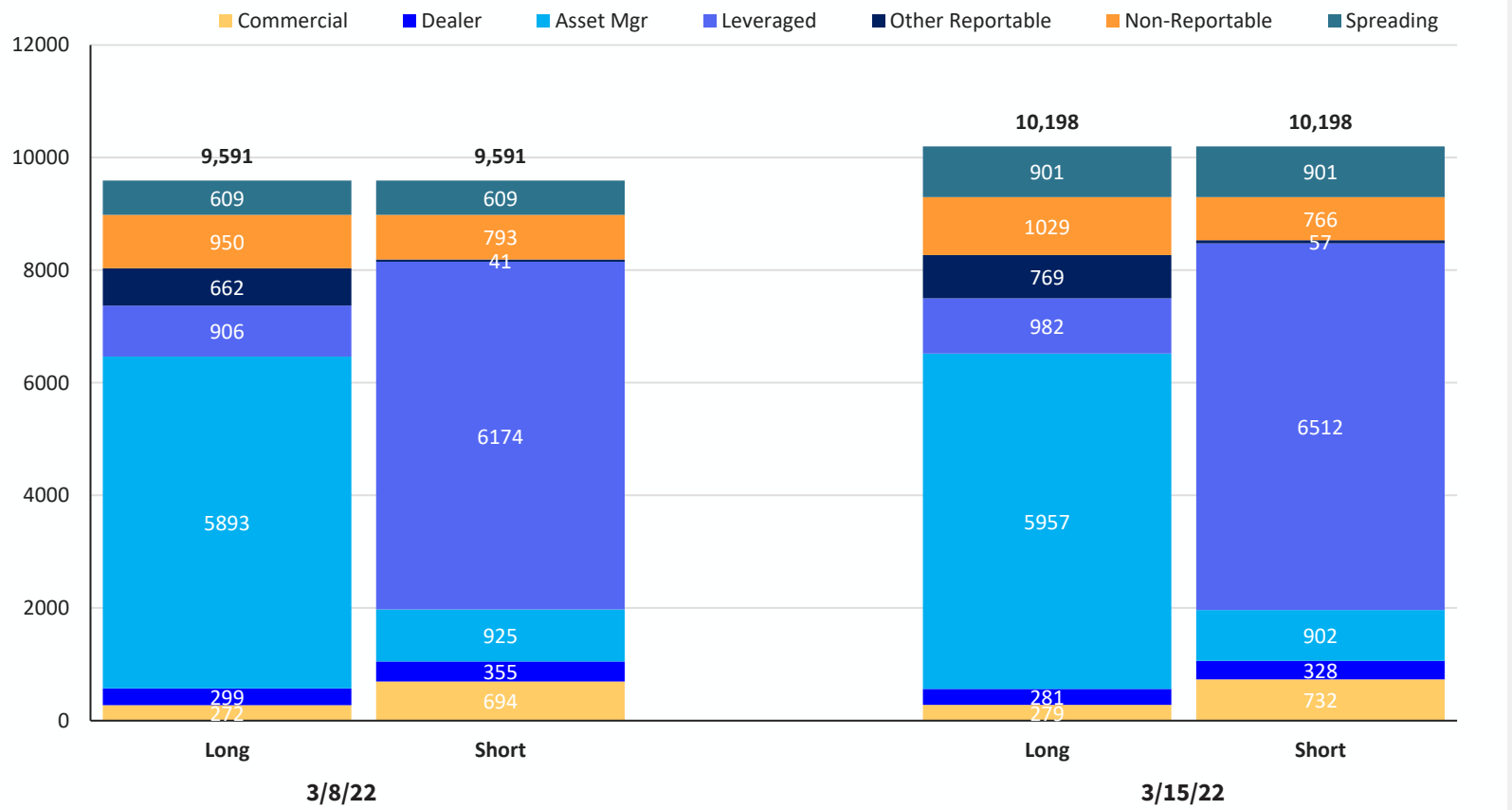


Figure: CME Bitcoin Commitment of Traders

Source: BitOoda, Bloomberg, CME

Non-Commercial Net Length Is Now 453 Lots

- Commercial Bitcoin players are not very active in the options space, participating mainly in the futures arena
- Commercial positioning has been largely long futures, but recently switched to short
- As a result, the net position for non-commercial market participants has been largely short, but long since December
- The net length for non-commercial participants fell modestly to 453 lots

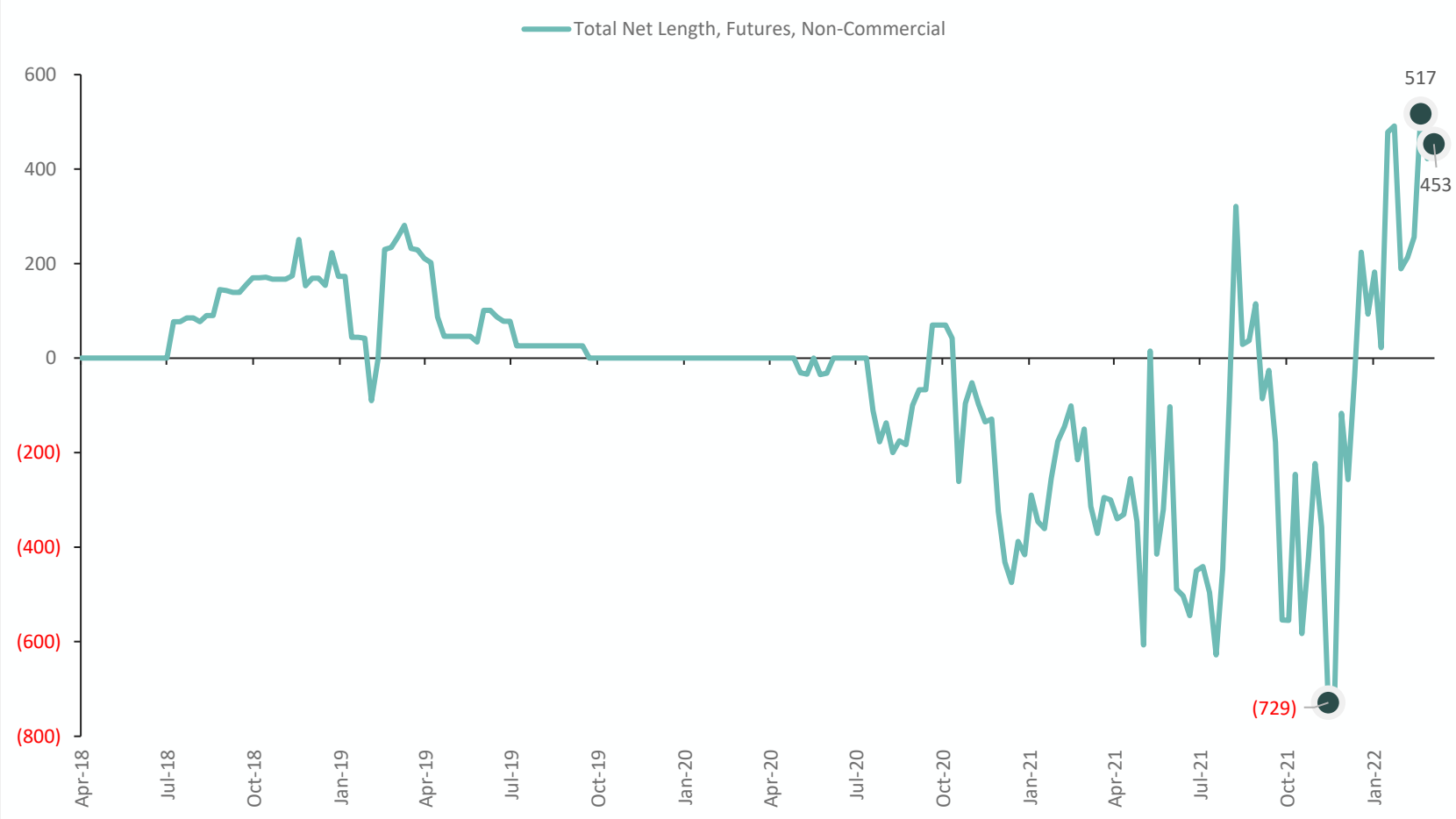


Figure: CME Bitcoin Future Non-Commercial Net Length, from April 2018

Source: Bloomberg

Disclosures

Purpose

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Sam Doctor, the research analyst denoted by an "AC" on the cover of this report, hereby certifies that all of the views expressed in this report accurately reflect his personal views, which have not been influenced by considerations of the firm's business or client relationships.

Conflicts of Interest

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