



March 3, 2022

Ms. Vanessa Countryman Secretary
Securities and Exchange Commission
100 F Street NE
Washington, D.C. 20549-0609

Re: Order Instituting Proceedings to Determine Whether to Approve or Disapprove a Proposed Rule Change to List and Trade Shares of Grayscale Bitcoin Trust (BTC) under NYSE Arca Rule 8.201-E
File No. SR-NYSEArca-2021-90
Release No. 34-94151

Dear Ms. Countryman:

Coinbase Global, Inc. (“Coinbase”) is submitting this letter in response to the Securities and Exchange Commission’s request for comments on whether to approve the proposed rule change filed by NYSE Arca, Inc. (the “Exchange”) to list and trade shares (“Shares”) of Grayscale Bitcoin Trust (BTC) (the “Trust”).¹ As described in the above-referenced release (the “Release”), the Commission is examining the proposal’s consistency with Section 6(b)(5) of the Securities Exchange Act of 1934, as amended (the “Exchange Act”), which requires, among other things, that the rules of a national securities exchange be “designed to prevent fraudulent and manipulative acts and practices” and “to protect investors and the public interest.” In particular, the Commission has asked:

What are commenters’ views on whether the proposed Trust and Shares would be susceptible to manipulation? What are commenters’ views generally on whether the Exchange’s proposal is designed to prevent fraudulent and manipulative acts and practices? What are commenters’ views generally with respect to the liquidity and transparency of the Bitcoin markets, the Bitcoin markets’ susceptibility to manipulation, and thus the suitability of Bitcoin as an underlying asset for an exchange-traded product?²

Coinbase started in 2012 with the radical idea that anyone, anywhere, should be able to easily and securely send and receive Bitcoin, the first digital asset. Coinbase built a trusted platform for accessing Bitcoin and the broader digital asset economy by reducing the complexity of buying and selling through a simple and intuitive user experience. Today, Coinbase is a leading provider of end-to-end financial infrastructure and technology for the crypto economy. Coinbase’s platform enables more than 89 million

¹ SEC; Release No. 34-94151; File No. SR-NYSEArca-2021-90; Self-Regulatory Organizations; NYSE Arca, Inc.; Order Instituting Proceedings to Determine Whether to Approve or Disapprove a Proposed Rule Change to List and Trade Shares of Grayscale Bitcoin Trust (BTC) under NYSE Arca Rule 8.201-E.

² *Id.*

verified users, 11,000 institutions, and 210,000 ecosystem partners in more than 100 countries to participate in the digital assets economy.

Coinbase is also one of the three digital asset trading platforms that provides pricing data, through its Coinbase Pro platform, to TradeBlock, Inc. as index provider to the Trust.³ In addition, Coinbase Custody Trust Company, LLC acts as custodian for the Trust's Bitcoin. We believe that our experience in providing these services, and our broader expertise in digital asset markets generally, is directly relevant to the questions being asked by the Commission in the Release.⁴

For the reasons discussed below, Coinbase believes that the Trust and the Shares would be no more susceptible to manipulation than other exchange-traded products ("ETPs") that the Commission has previously concluded satisfy the requirements of Section 6(b)(5) of the Exchange Act, and therefore believes that the Exchange's proposal is appropriately designed to prevent fraudulent and manipulative acts and practices. Moreover, as our accompanying analysis shows, the Bitcoin markets exhibit characteristics and maturity commensurate with some of the deeply traded markets in commodities and U.S. equities. The liquidity and transparency of the Bitcoin markets limits its susceptibility to manipulation, which we believe further demonstrates the suitability of Bitcoin as an underlying asset for an ETP.

There are numerous barriers to manipulation of the Bitcoin market, which we discuss in more detail below, that serve to improve market integrity and protect public and investor interests. First, the depth of order books, diversity of market participants, and transparency of prices in the Bitcoin market serve to quickly close arbitrage opportunities, including any that may be due to attempted price manipulation. As shown in the analysis below, Bitcoin prices on the Bitcoin exchanges that are included in the Grayscale ETP's pricing algorithm do not, in practice, deviate significantly across the exchanges. Any attempt to materially move the price of Bitcoin would require significant trading volume across several large exchanges.

Second, exchanges such as Coinbase have robust surveillance and monitoring practices in place designed to identify and prevent manipulative or fraudulent trading activity. These practices address, among other things, the Commodity Exchange Act's prohibitions on manipulative and fraudulent trading activity. Coinbase has demonstrated its commitment to these efforts, believes other reputable Bitcoin exchanges have similar capabilities in place, and will continue to share best practices across all digital asset markets with other parties through initiatives such as the Crypto Market Integrity Coalition.⁵

³ SEC; Release No. 34-93504; File No. SR-NYSEArca-2021-90 Self-Regulatory Organizations; NYSE Arca, Inc.; Notice of Filing of Proposed Rule Change to List and Trade Shares of Grayscale Bitcoin Trust (BTC) under NYSE Arca Rule 8.201-E at 16–29, 33–35, 37–42.

⁴ Coinbase previously submitted a comment letter in support of the proposed rule change. See letter of Paul Grewal, Chief Legal Officer, Coinbase Global, Inc. (Dec. 14, 2021), <https://www.sec.gov/comments/sr-nysearca-2021-90/srnysearca202190-20109603-263970.pdf>.

⁵ Michael Bellusci, *Leading Digital Exchanges Launch Crypto Market Integrity Coalition*, (Feb. 7, 2022),

Third, prices and volumes of Bitcoin futures versus Bitcoin spot markets are highly correlated, indicating very similar market dynamics between the futures market, for which the Commission has approved a Bitcoin ETP, and the spot market.

Fourth, the Bitcoin spot market is comparably large and transparent compared to silver, palladium, and platinum markets, for which spot ETPs have been approved by the Commission. When compared across key market dimensions – trading volume, capitalization, and number of active trading venues – the Bitcoin spot market is more robust, a sign of lower likelihood of successful market manipulation.

Fifth, Bitcoin spot ETPs' performance in other countries confirms the ability of a Bitcoin spot ETP to appropriately reflect the underlying Bitcoin market. At least seven other national jurisdictions⁶ have already approved at least one Bitcoin spot ETP, and Germany, Canada, and Jersey have each approved several. As our analysis of Bitcoin ETPs in these markets demonstrates, there is a high correlation between the Bitcoin ETP price changes and those of the underlying Bitcoin market, indicating that Bitcoin ETP pricing algorithms ensure the ETP closely tracks the underlying market prices. The Trust's pricing methodology employs global best practices, including (i) basing price off of multiple exchanges; (ii) weighting by relative volumes, price deviations, and recency of activity; and (iii) filtering inputs to select exchanges and trade datasets that are more resistant to manipulation, and should result in similar tracking of the underlying Bitcoin markets.

1. Market Depth, Liquidity, and Transparency

Bitcoin's average daily trading volume in 2021 was approximately \$45 billion **[Figure 1]**, demonstrating the Bitcoin market's depth and liquidity. As a point of comparison, this trading volume is significantly higher than that of the largest national market system stocks **[Figure 2]**, including Apple, Microsoft, and Amazon, which are some of the most liquid trading instruments available. Several institutional investors including asset managers, hedge funds, and public companies participate in the Bitcoin market, and surveys indicate interest from institutional investors continues to increase for Bitcoin and a potential ETP on the Bitcoin spot market.⁷

As the Commission previously recognized in its approval of the streetTRACKS Gold Trust, another commodity market with no direct regulation of spot trading, the depth and

<https://www.coindesk.com/business/2022/02/07/leading-digital-exchanges-announce-launch-of-crypto-market-integrity-coalition/>.

⁶ Canada, Germany, Switzerland, Jersey, Liechtenstein, Sweden, and Brazil.

⁷ See, e.g., Lawrence Wintermeyer, *Institutional Money Is Pouring Into The Crypto Market And Its Only Going To Grow*, (Aug. 12, 2021),

<https://www.forbes.com/sites/lawrencewintermeyer/2021/08/12/institutional-money-is-pouring-into-the-crypto-market-and-its-only-going-to-grow/?sh=796cd85a1459> (discussing asset managers' increasing participation in the digital asset market); Stephen Graves, Daniel Phillips, *The 10 Public Companies With the Biggest Bitcoin Portfolios*, (Dec. 2021),

<https://decrypt.co/47061/public-companies-biggest-bitcoin-portfolios>; institutions investing in bitcoin is expected to increase (listing public companies that hold Bitcoin);

<https://cointelegraph.com/news/62-of-institutions-to-start-investing-in-crypto-within-a-year-survey> (discussing institutional investors' increasing participation in the digital asset market).

liquidity of underlying spot markets allay concerns with improper trading practices.⁸ The magnitude of the Bitcoin trading market, with greater average trading volume than any single equity security, should provide the Commission with equal comfort that any attempted manipulations would be mitigated through fundamental trading and intermarket trading activity, including the Bitcoin futures market.⁹

Our empirical research supports this conclusion, showing that Bitcoin spot prices do not deviate significantly across digital asset exchanges. In a comparison of hour-end prices for Bitcoin across the four exchanges used as inputs to the Trust's pricing, the exchanges showed less than 20 bps deviation 97% of the time over a roughly three-year time horizon **[Figure 3]**. This deviation is low even when compared to certain liquid markets, including:

- Government and retail money market funds;¹⁰ and
- Dual-listed stocks with equivalent economic interest as shown in **[Figure 4]**.

While there were instances where prices across these Bitcoin exchanges experienced higher deviations than 20 bps, the vast majority (e.g., 90% of deviations greater than 1%) were driven by a single exchange's pricing with less than 5% of the trading volume **[Figure 3]**. Because the TradeBlock index price uses a weighted average of prices based on trading volume, these deviations would have only a de minimis impact on the Trust's pricing. In the remaining instances, price differences quickly closed by intermarket trading, typically within one hour, with the exception of two price deviations that lasted three hours during the onset of the Covid-19 pandemic **[Figure 5]**. Hence, these larger deviations are commensurate with the infrequent occurrence of extreme events that can occasionally impact the trading of any and all financial market assets.

These observations and interpretations are consistent with those expressed previously by the Commission – that a strong convergence of pricing across a broad market is present where spot markets are deep and liquid.¹¹ Given the significant spot market volume and efficiency of inter-exchange price correction in Bitcoin spot markets, manipulating the price for shares of the Trust by manipulating spot markets would require a prohibitively large amount of trading volume and coordination across several

⁸ SEC; Release No. 34-50603; File No. SR-NYSE-2004-22; Self-Regulatory Organizations; Order Granting Approval of Proposed Rule Change and Notice of Filing and Order Granting Accelerated Approval to Amendments No. 1 and No. 2 Thereto to the Proposed Rule Change by the New York Stock Exchange, Inc. Regarding Listing and Trading of streetTRACKS[®] Gold Shares at 65619.

⁹ *Id.*

¹⁰ According to Investment Company Act Rule 2a-7, government and retail money market funds can choose a penny rounding approach when listing prices, which can result in up to a 50 bp deviation. 17 CFR § 270.2a-7(c)(1)(i).

¹¹ SEC; Release No. 34-50603; File No. SR-NYSE-2004-22; Self-Regulatory Organizations; Order Granting Approval of Proposed Rule Change and Notice of Filing and Order Granting Accelerated Approval to Amendments No. 1 and No. 2 Thereto to the Proposed Rule Change by the New York Stock Exchange, Inc. Regarding Listing and Trading of streetTRACKS[®] Gold Shares.

large exchanges.¹² Further, activity on this scale would be readily detected as a result of surveillance activity covered in the next section.

2. Exchange Surveillance and Monitoring Practices

The market for any commodity is, of course, subject to the risk of manipulation. Addressing this risk is a foundational element of Coinbase's strategy, because the integrity of the Bitcoin market and digital asset markets generally is fundamental to our business and essential to protecting our customers. Coinbase has invested heavily in market surveillance and monitoring, including complying with federal anti-fraud and anti-manipulation rules that apply to digital asset markets under the Commodity Exchange Act and regulations of the Commodity Futures Trading Commission.¹³

In addition to the measures undertaken by Tradeblock, Inc. to address the effect of potentially manipulative or fraudulent trading on the Index,¹⁴ and in addition to measures employed by CFTC-regulated futures exchanges for Bitcoin futures contracts, Coinbase applies surveillance and monitoring measures for its spot digital asset trading platforms designed to identify and address potential manipulative or fraudulent trading activity on those platforms. We believe that the other digital asset exchanges that provide pricing data as inputs to the Index also employ measures to counter potential fraudulent or manipulative trading. In these comments, we describe our own approach.

Coinbase established its current market surveillance and monitoring program in 2018. Its market surveillance and monitoring team currently includes ten professionals, led by a former NYSE executive. As part of this program, Coinbase uses a cutting-edge

¹² Given the market complexity, volatility, and evolving landscape, it is not possible to precisely determine the trading volume required to shift market prices. However, an analysis by Bank of America in 2021 indicated \$93 MM required to move Bitcoin price by \$1. See Samuel Haig, *Bank of America claims it costs just \$93 million to move Bitcoin's price by 1%*, (Mar. 19, 2021), <https://cointelegraph.com/news/bank-of-america-claims-it-costs-just-93-million-to-move-bitcoin-s-price-by-1>. Although it is unclear whether a linear extrapolation of this price impact measure is appropriate, it would correspond to requiring \$44 BN to shift the Bitcoin price by 1% when trading at \$47,464 (the average close price in 2021 based on data from Yahoo Finance). Coinbase would venture this would be prohibitively expensive, given average daily trading volume in 2021 was \$45 BN and the average daily volatility of Bitcoin is greater than 1%.

¹³ Section 6(c)(1) of the Commodity Exchange Act, 7 U.S.C. § 9. This authority does not extend to regulation and supervision of these markets. For a summary of this topic, see CFTC Commissioner Stump, *Digital Assets: Clarifying CFTC Regulatory Authority & the Fallacy of the Question, "Is it a Commodity or a Security?"*, (Aug. 23, 2021), <https://www.cftc.gov/PressRoom/SpeechesTestimony/stumpstatement082321>.

¹⁴ SEC; Release No. 34-93504; File No. SR-NYSEArca-2021-90 Self-Regulatory Organizations; NYSE Arca, Inc.; Notice of Filing of Proposed Rule Change to List and Trade Shares of Grayscale Bitcoin Trust (BTC) under NYSE Arca Rule 8.201-E at 19 ("The Index Price is determined by the Index Provider through a process in which trade data is cleansed and compiled in such a manner as to algorithmically reduce the impact of anomalistic or manipulative trading. This is accomplished by adjusting the weight of each data input based on price deviation relative to the observable set, as well as recent and long-term trading volume at each venue relative to the observable set. To calculate volume weighted price, the weighting algorithm is applied to the price and volume of all inputs for the immediately preceding 24-hour period at 4:00 PM, New York time, on the trade date.").

surveillance technology called Eventus. The program employs machine learning methods to provide 24/7/365 market surveillance and monitoring across all Coinbase digital asset trading platforms. The program monitors for the types of potentially manipulative or fraudulent trading activity that are at times observed in traditional financial markets – spoofing, wash trading, trade layering, front-running, churning, and quote stuffing.¹⁵ While traditional financial market surveillance often relies upon T+1 or T+2 (day) market data, the Coinbase surveillance program issues same-day alerts so that the Coinbase trade surveillance team can investigate and quickly address the triggering activity.

In addition to our surveillance program, Coinbase employs measures similar to circuit breakers and trading limits used in traditional financial markets to address potential manipulative or fraudulent trading activity. For example, Coinbase imposes a trading limit called the market protection point – an order on Coinbase Pro that is large enough to move the price of Bitcoin more than two percent is filled only up to that two-percent amount, with the remainder of the order being canceled to mitigate non-fundamental price impact and avoid undue market swings.¹⁶ Coinbase also monitors digital asset prices on other exchanges, and significant differences between the prices on Coinbase platforms and other exchanges triggers scrutiny and testing by the Coinbase team to assess whether these differences may reflect potential manipulative or fraudulent trading activity that should be addressed.

Coinbase has policies and procedures in place, many of which are available publicly, that describe our trade surveillance program and our practices to address potential market manipulation or fraudulent trading activity.¹⁷ Coinbase employees are subject to trading policies designed to ensure that their trading activities are consistent with applicable federal anti-fraud and anti-manipulation laws.¹⁸ These policies and procedures are subject to annual audits to ensure a strong compliance culture.

Finally, Coinbase participates in industry initiatives meant to further address potential manipulative and fraudulent trading activity in Bitcoin, such as the recently announced Crypto Market Integrity Coalition, which is designed to facilitate cross-exchange surveillance and bolster the integrity and efficiency of digital asset markets.¹⁹ Coinbase

¹⁵ The Coinbase Blog, *How Coinbase thinks about market integrity and trade surveillance*, (Oct. 11, 2021), <https://blog.coinbase.com/how-coinbase-thinks-about-market-integrity-and-trade-surveillance-f3d4c7a53d0>.

¹⁶ Coinbase, *Market Information*, <https://pro.coinbase.com/markets>.

¹⁷ The Coinbase Blog, *How Coinbase thinks about market integrity and trade surveillance*, (Oct. 11, 2021), <https://blog.coinbase.com/how-coinbase-thinks-about-market-integrity-and-trade-surveillance-f3d4c7a53d0>; Coinbase, *Market Information*, <https://pro.coinbase.com/markets>.

¹⁸ The Coinbase Blog, *How Coinbase thinks about market integrity and trade surveillance*, (Oct. 11, 2021), <https://blog.coinbase.com/how-coinbase-thinks-about-market-integrity-and-trade-surveillance-f3d4c7a53d0>.

¹⁹ See Crypto Market Integrity Coalition, *Enabling a Safer Crypto Ecosystem*, <https://www.cryptomarketintegrity.com/>.

will continue to seek opportunities to collaborate with other digital asset market participants to improve cross-market surveillance.

3. Comparison of Bitcoin Spot and Futures Markets

An important comparison point for the approval of a Bitcoin spot ETP is the recently approved CME Bitcoin futures ETF. Given that the reference price for the CME Bitcoin futures ETF is driven by the same data that underlies the Bitcoin spot market, there is an unsurprisingly high correlation of 99.9% between the price of the futures²⁰ and spot market **[Figure 6]**.

These data are consistent with arbitrageurs forcing price convergence by selling in one market – spot or futures – and buying in the other. These data are also consistent with the Commission’s original determination that manipulation of the underlying Bitcoin market is sufficiently mitigated for approval of ETFs based on Bitcoin futures. Coinbase believes this same logic supports approval of a Bitcoin spot ETP – there is no economic justification for a differential impact on the efficacy of a Bitcoin futures ETF or spot Bitcoin ETP from any potential manipulation of the underlying Bitcoin market.

In fact, given that the Bitcoin spot market shows higher and more stable daily trading volumes than the futures ETF **[Figure 7]**, Coinbase believes the presence of an approved Bitcoin spot ETP may bolster and stabilize the broader Bitcoin derivatives market by encouraging a still greater volume of activity and easier arbitrage between the two markets. This rationale was cited by the Commission in approving previous commodity ETPs.²¹

It should be noted that effects of an existence of a spot ETP on the underlying market is well studied in the literature²² and the introduction of an ETP can enhance price discovery in the underlying markets by increasing informational efficiency.

²⁰ The Bitcoin futures price in this analysis is represented by the price of the futures contracts listed by CME that is closest to maturity at any point in time, representing a 30-day window. While historical observations of futures contracts farther from settlement date indicate a contango effect (i.e., futures trading at higher prices than the underlying spot), this effect is not observable and the future and spot market converge closer to futures contracts settlement date.

²¹ SEC; Release No. 34-50603; File No. SR-NYSE-2004-22; Self-Regulatory Organizations; Order Granting Approval of Proposed Rule Change and Notice of Filing and Order Granting Accelerated Approval to Amendments No. 1 and No. 2 Thereto to the Proposed Rule Change by the New York Stock Exchange, Inc. Regarding Listing and Trading of streetTRACKS® Gold Shares and SEC Release No. 34-68440; File No. SR-NYSEArca-2012-28 Self-Regulatory Organizations; NYSE Arca, Inc.; Notice of Filing of Amendment No. 1 and Order Granting Accelerated Approval of a Proposed Rule Change as Modified by Amendment No. 1 to List and Trade Shares of the JPM XF Physical Copper Trust Pursuant to NYSE Arca Equities Rule 8.201.

²² Lawrence Glosten, Suresh Nallareddy, Yuan Zou, *ETF Activity and Informational Efficiency of Underlying Securities*, (April 2020); Blackrock, *Lessons from COVID-19: ETFs as a Source of Stability*, (July 2020), <https://www.blackrock.com/corporate/literature/whitepaper/viewpoint-lessons-from-covid-19-etfs-a-s-a-source-of-stability-july-2020.pdf>.

4. Comparison of the Bitcoin Spot Market and Other Commodity Markets

The Bitcoin spot market is of comparable size to several of the commodity markets for which the SEC has previously approved spot ETPs, with total market capitalization lower than silver and greater than palladium and platinum **[Figure 8]**.

Given the opacity of the commodity OTC market – transparency that is considerably less than the commodity Bitcoin market – Coinbase cannot definitively compare the market depth of the Bitcoin market and those commodity markets. However, Coinbase believes available research and data indicate higher trading volumes in the Bitcoin spot market than the silver OTC market:

- London has a majority share of the global OTC market for silver (estimated at 70% in 2017);²³
- The London OTC market had an estimated trade reporting weekly turnover of \$30.84 BN for silver in the last 12 weeks of 2021; and²⁴
- The Bitcoin market had an average weekly trading volume of \$233 BN in the same timeframe (last 12 weeks of 2021).²⁵

A comparison of non-US Bitcoin spot ETPs to approved commodity ETPs (e.g., ETPs for palladium, platinum, silver, copper) indicate that the ETP's ability to closely track the underlying asset price is comparable between Bitcoin and other commodities **[Figure 9]**. This rationale was cited by the Commission in approving previous commodity ETPs.²⁶

5. Experience of Non-US Bitcoin Spot ETPs

The performance of Bitcoin spot ETPs in other countries is a helpful benchmark in assessing the ability of a US-traded Bitcoin spot ETP to appropriately reflect the underlying Bitcoin market. Coinbase has identified seven countries that have approved a total of 16 Bitcoin spot ETPs **[Figure 10]**, with Germany, Canada, and Jersey each having approved multiple ETPs. Analysis of the German, Canadian, and Jersey ETPs demonstrates a high correlation between the ETP price and that of the underlying Bitcoin market. **[Figure 11-12 and 13-16]**. This indicates that Bitcoin spot ETPs accurately

²³ The Silver Institute, *World Silver Survey 2018*, <https://www.silverinstitute.org/wp-content/uploads/2018/04/WSS-2018.pdf> at 18.

²⁴ LBMA, *LBMA Trade Data*, <https://www.lbma.org.uk/prices-and-data/lbma-trade-data>.

²⁵ Weekly average of data from Yahoo Finance on Bitcoin volumes, sourced from coinmarketcap.com.

²⁶ See, e.g., SEC; Release No. 34-50603; File No. SR-NYSE-2004-22; Self-Regulatory Organizations; Order Granting Approval of Proposed Rule Change and Notice of Filing and Order Granting Accelerated Approval to Amendments No. 1 and No. 2 Thereto to the Proposed Rule Change by the New York Stock Exchange, Inc. Regarding Listing and Trading of streetTRACKS® Gold Shares.

reflect the underlying Bitcoin market and provide investors exposure to Bitcoin without the need to trade Bitcoin itself.

There are global best practices that Bitcoin spot ETPs can use to mitigate potential manipulation of their share prices and so that these prices more closely reflect the underlying Bitcoin market. The Trust's pricing methodology employs these best practices including (i) using an index whose price is based upon data from multiple exchanges, (ii) weighting pricing data by relative volumes, price deviations, and recency of activity, and (iii) using an index that filters inputs to select exchanges and trade datasets that are more resistant to manipulation, and should result in similar tracking of the underlying Bitcoin markets.

* * *

We appreciate the opportunity to provide input to the Commission as it considers the Exchange's proposal. The characteristics of the Bitcoin market, as described in the data and analysis in this letter, support the position that the Trust and the Shares would be no more susceptible to manipulation than other ETPs previously approved by the Commission. For that reason, approval of the Exchange's proposal is the appropriate action for the Commission to take.

We would be pleased to answer any questions the Commission or its staff may have on the data and analysis presented above. We appreciate the Commission's continuing attention to this important matter and for allowing us an opportunity to present our views.

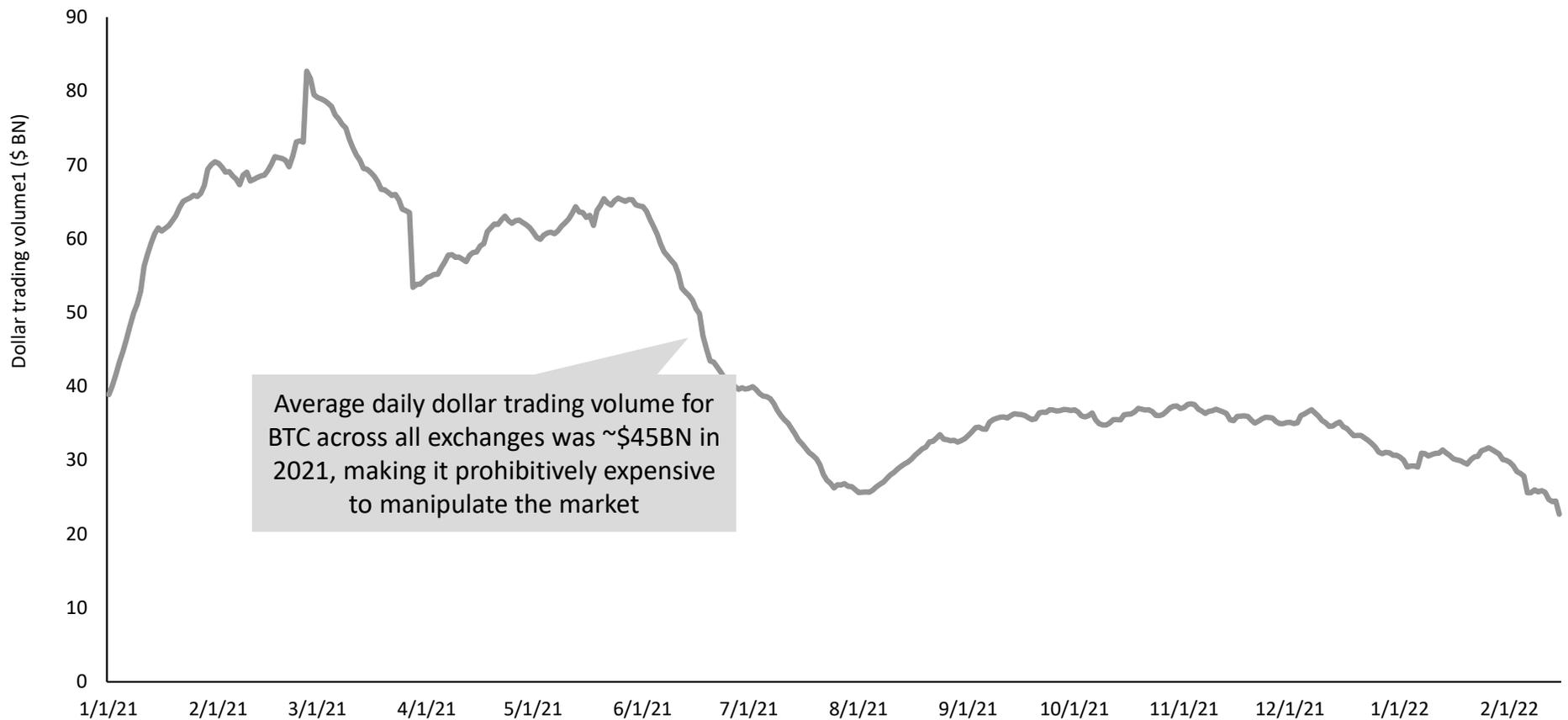
Sincerely,



Paul Grewal
Chief Legal Officer

Figure 1: Bitcoin spot market depth mitigates ability to manipulate multiple large exchanges

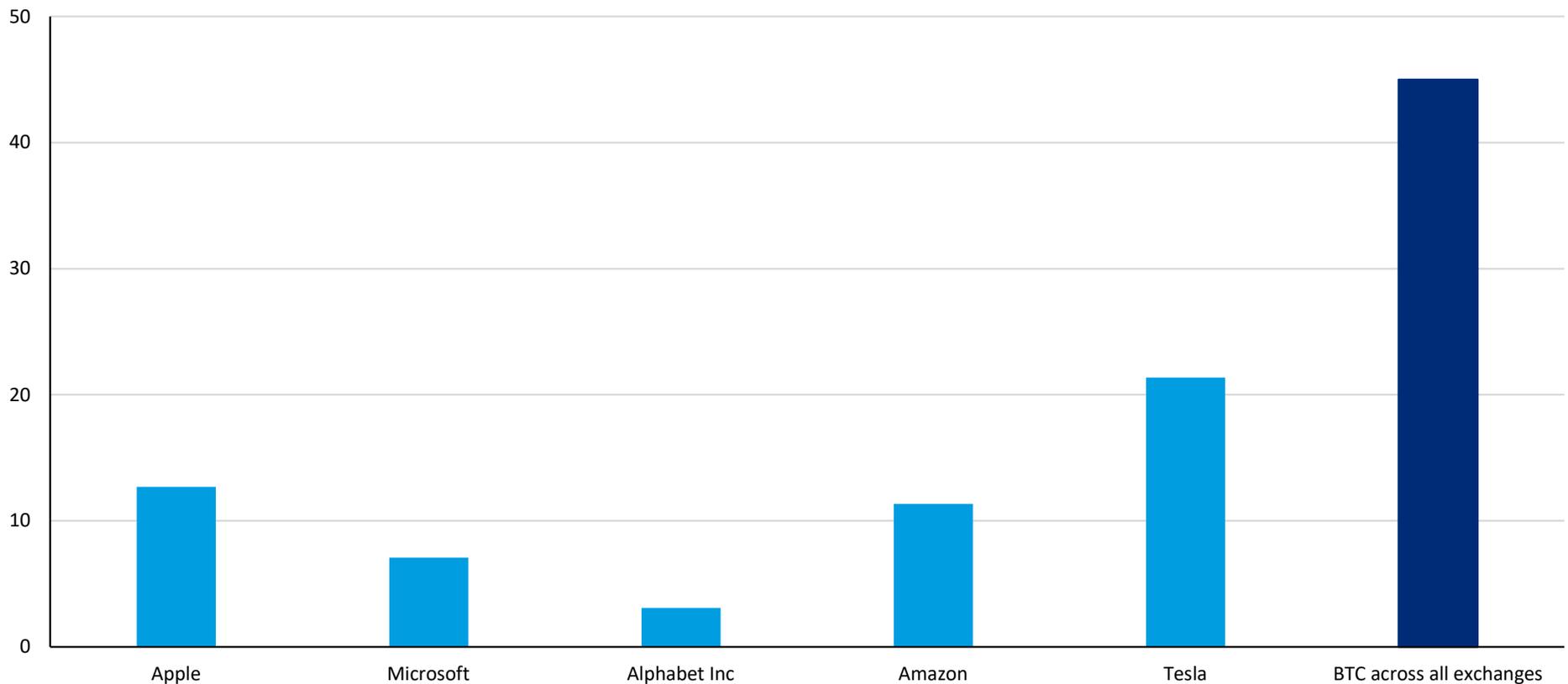
Daily dollar trading volume on BTC spot exchanges¹
30-day rolling average, 1/1/21-2/14/22



1. Daily volume is in dollars and represents the total spot trading volume reported by all exchanges over the last 24 hours for that cryptoasset
Source: Data pulled from Yahoo Finance, originally sourced from Coinmarketcap.com

Figure 2: Bitcoin spot market depth is greater than that of the largest individual equities

Average daily dollar volume across Bitcoin exchanges¹ vs. largest S&P 500 stocks²
\$ BN, daily average over 2021

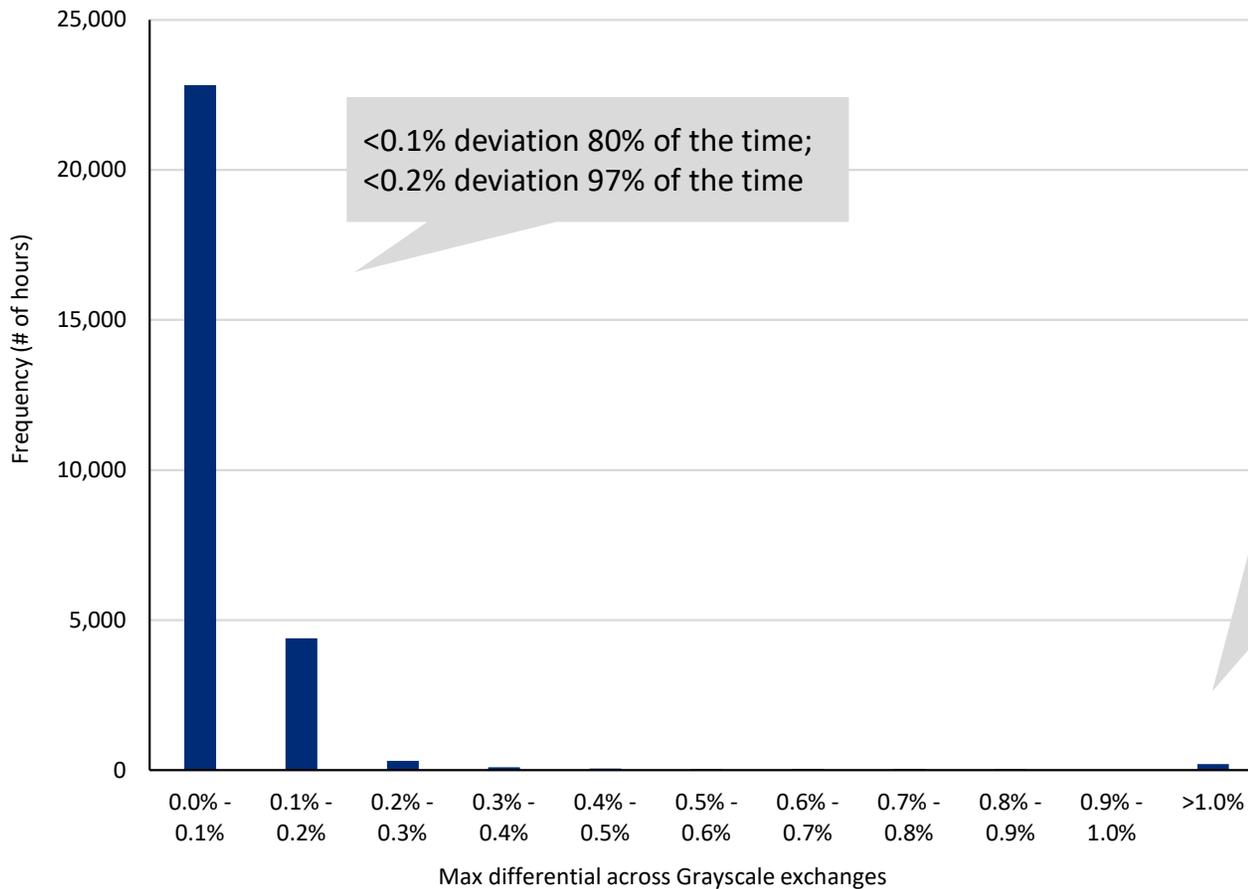


1. Bitcoin volume is pulled from Yahoo Finance, originally sourced from Coinmarketcap.com. Daily volume is in dollars and represents the total spot trading volume reported by all exchanges over the last 24 hours for that cryptoasset

2. Largest stocks by Market Cap as of 1/31/22 according to Statista. Trading volume and price sourced from Yahoo Finance, with dollar volume calculated as the average price * average daily trading volume

Figure 3: Historical price differential across exchanges

Frequency of each level of deviation across 4 exchanges¹
 Close of every trading hour, 12/8/18 – 2/15/22



202 instances (i.e., 202 hourly closes over roughly 3-year time horizon) with >1% price deviation across exchanges

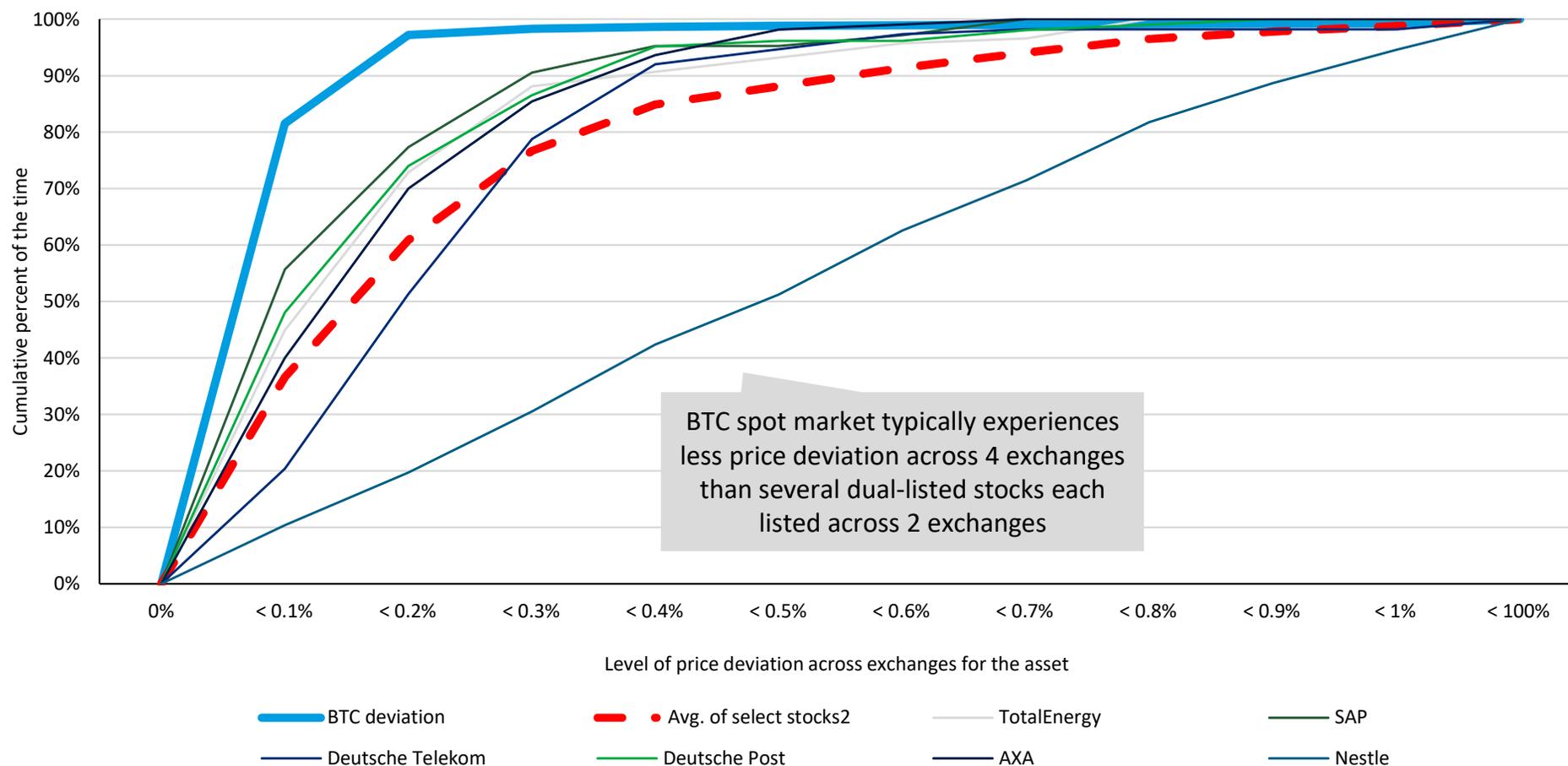
- 180 instances were driven by a single exchange (lmax), which contributed <5% of volume across 4 exchanges
 - This has minimal impact given Grayscale ETF price is average weighted by volume
- 16 instances where >1% deviation between exchanges, and price difference reduced to below 1% by the next trading hour close
- 6 instances (i.e., 2 periods of 3 hours) over March 12-13, 2020 during the onset of Covid-19, where price deviation persisted across the trading close of three consecutive hours

1. Exchanges include Coinbase, Bitstamp, Kraken, Lmax
 Source: CryptoCompare Data

Figure 4: Price deviation in BTC spot market is lower than that of select dual-listed stocks across exchanges

Price deviation across exchanges for BTC spot market¹ and select dual-listed stocks²

Close of every trading hour, 1/10/22 – 2/23/22



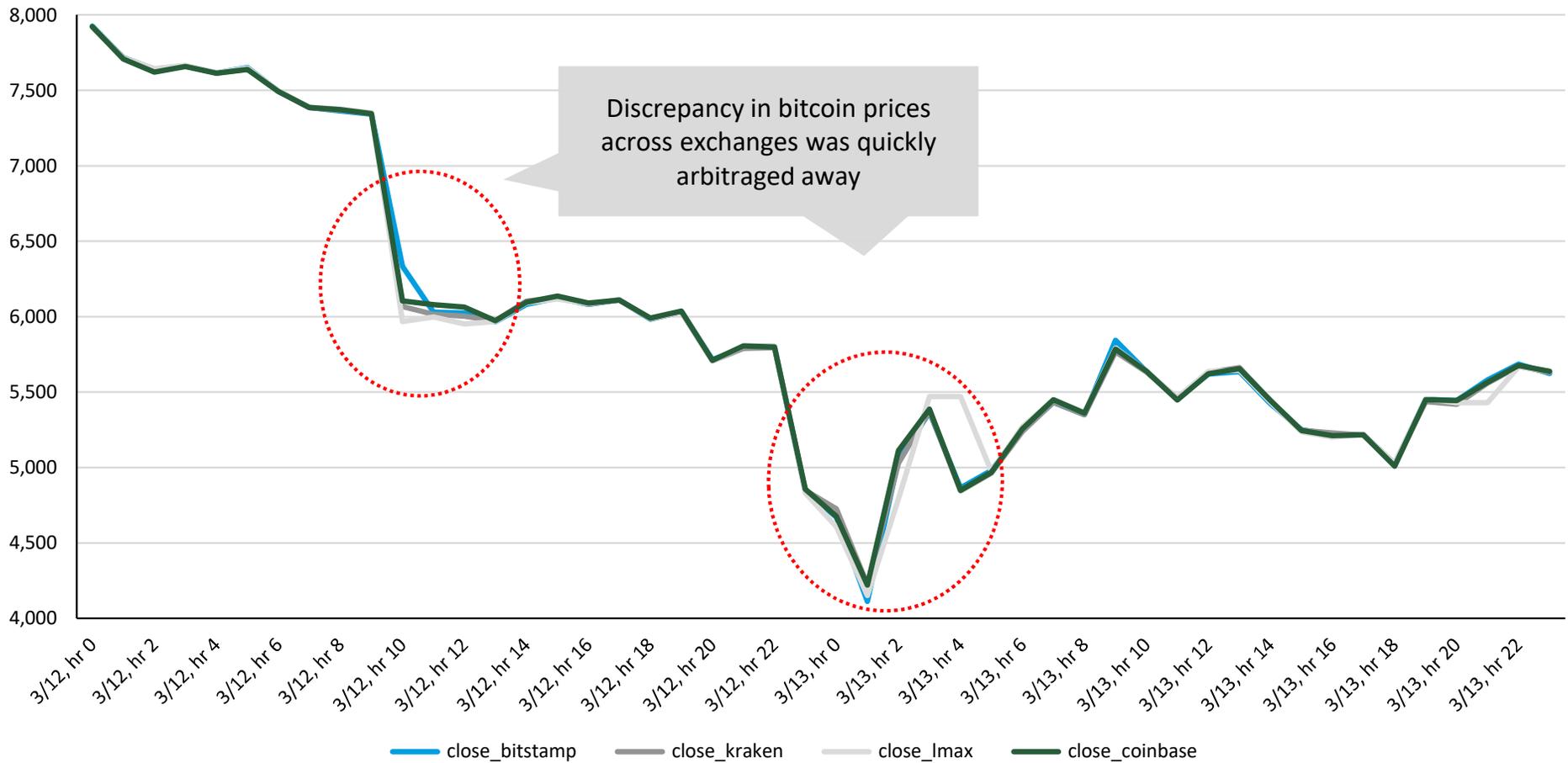
1. Exchanges include Coinbase, Bitstamp, Kraken, Lmax; data sourced from CryptoCompare

2. Dual-listed stock data sourced from Frankfurt Stock exchange, Euronext Paris, U.S. exchanges and U.S. OTC Markets via Bloomberg; currency conversion rates between exchanges sourced from Bloomberg

Figure 5: When BTC prices deviated, they closed very quickly

Bitcoin price across 4 exchanges¹

Close of every trading hour, 3/12/20 – 3/13/20



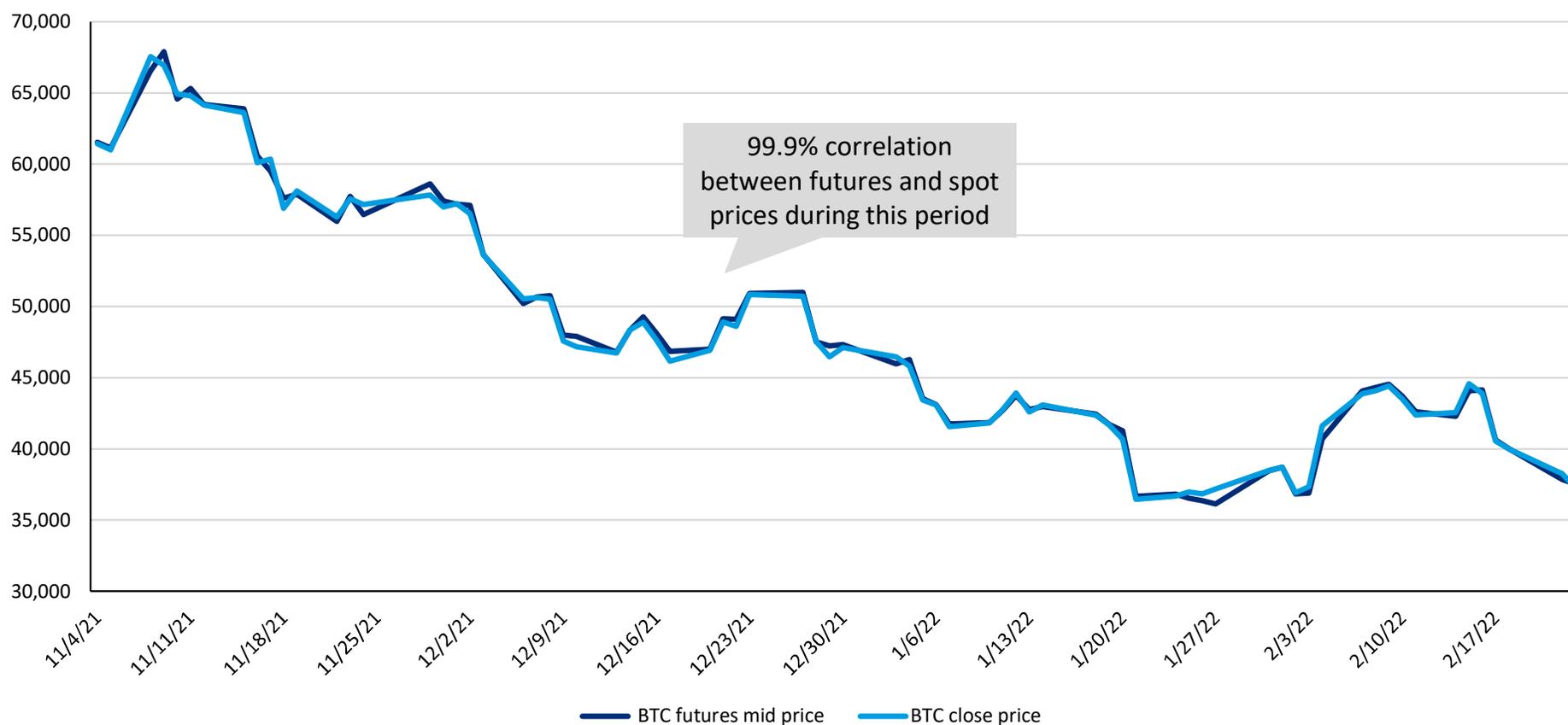
1. Exchanges include Coinbase, Bitstamp, Kraken, Lmax

Source: CryptoCompare Data

Figure 6: Price is highly correlated between BTC CME futures and BTC spot market

Daily price for BTC futures¹ and spot markets

\$, 11/4/21 – 2/23/22

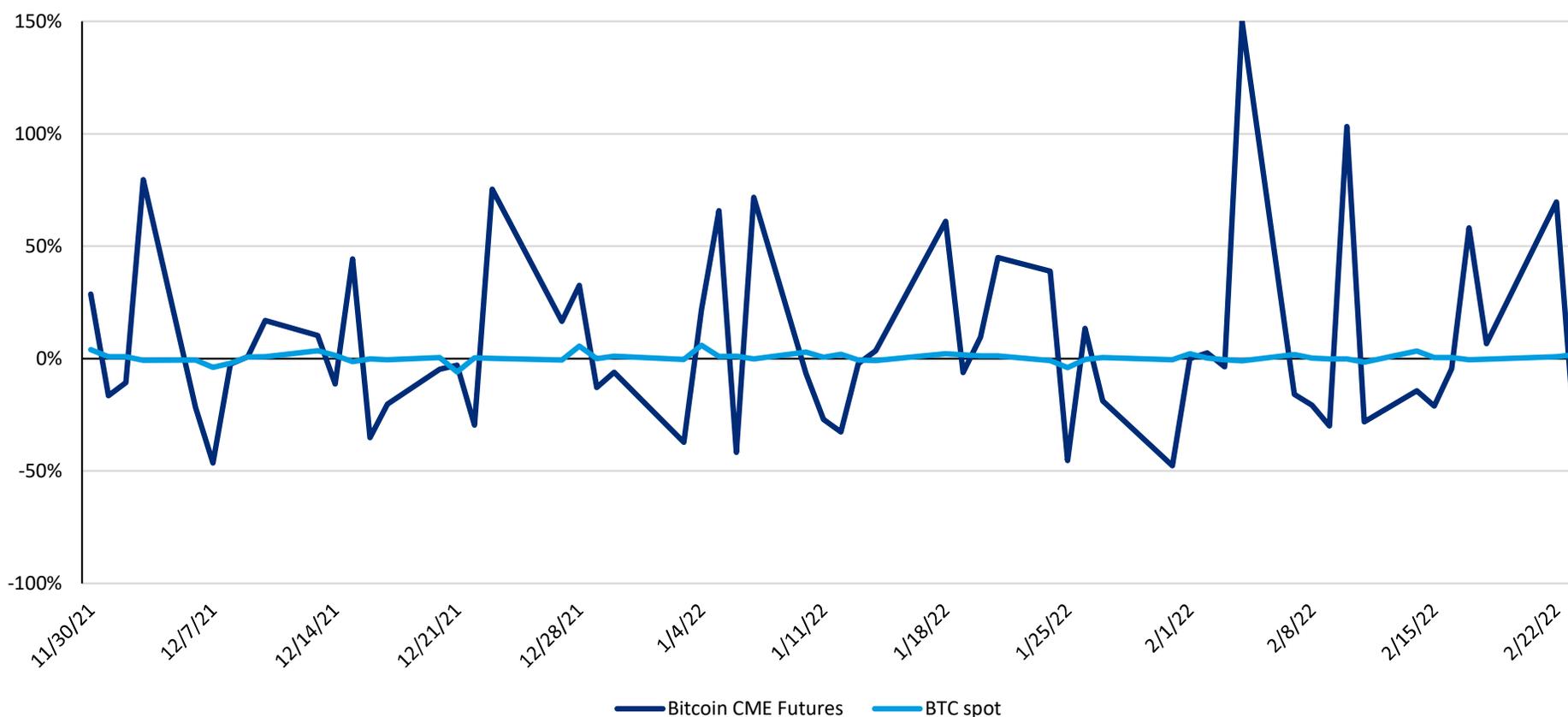


1. BTC future price represented by "CME BTC Generic 1st Future" listed on Bloomberg; this price represents the price of the future contract listed by CME that is closest to maturity (e.g., December 2021 prices represented by price of BTCZ1 future contract that matures on the last Friday of December)

Source: Bitcoin CME Futures price sourced from Bloomberg, Bitcoin price listed by Coinbase sourced from CryptoCompare

Figure 7: Volume is more volatile for BTC CME futures than BTC spot market

Daily percentage change in trading volume for BTC futures¹ and spot markets
11/30/21 – 2/23/22



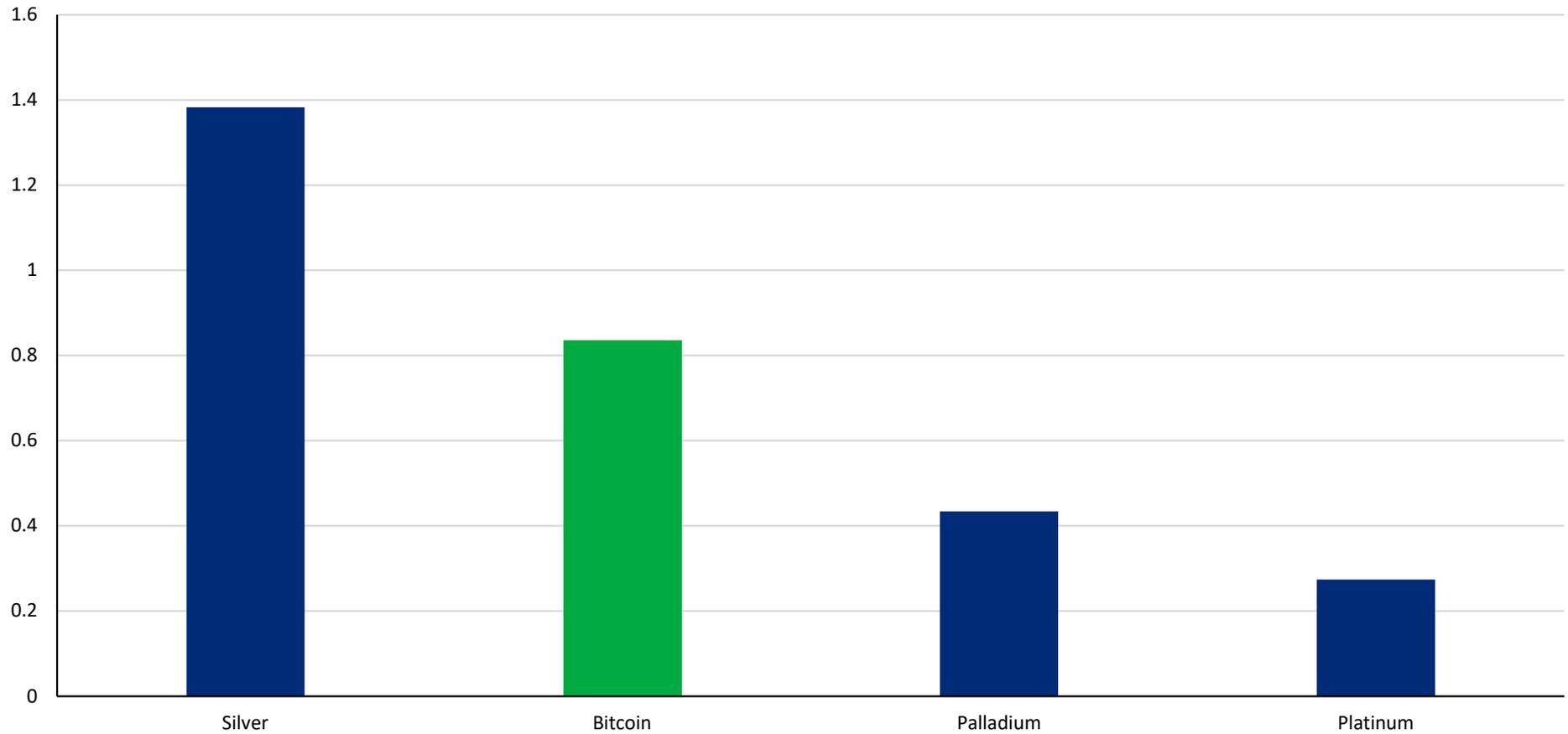
1. BTC futures volume represented by "CME BTC Generic 1st Future" listed on Bloomberg; the "CME BTC Generic 1st Future" represents the future contract listed by CME that is closest to maturity (e.g., for December 2021 it tracks the BTCZ1 future contract that matures on the last Friday of December)

Source: Bitcoin CME Futures volume sourced from Bloomberg, Bitcoin spot volume from CoinMarketCap

Figure 8: Bitcoin is comparable in market size to several commodities for which ETFs have been approved

Market cap

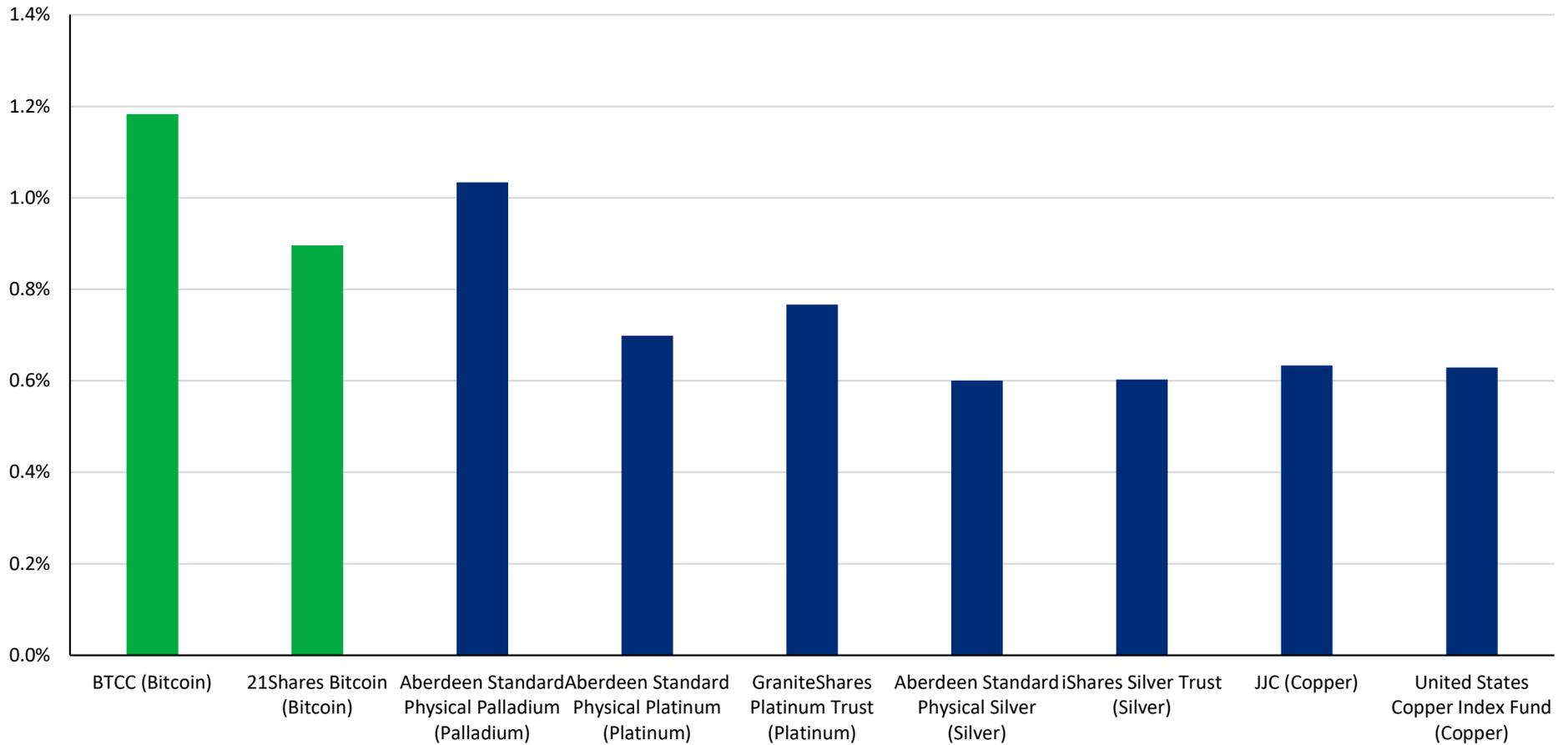
\$ TN, as of 2/15/22



Source: BTC market capitalization from Coinmarketcap, commodities market capitalization from companiesmarketcap.com

Figure 9: Ability for ETF to closely track underlying asset price is comparable between Bitcoin and other commodities

Average absolute difference in daily price change between ETF and underlying asset
1/14/22 - 2/16/22



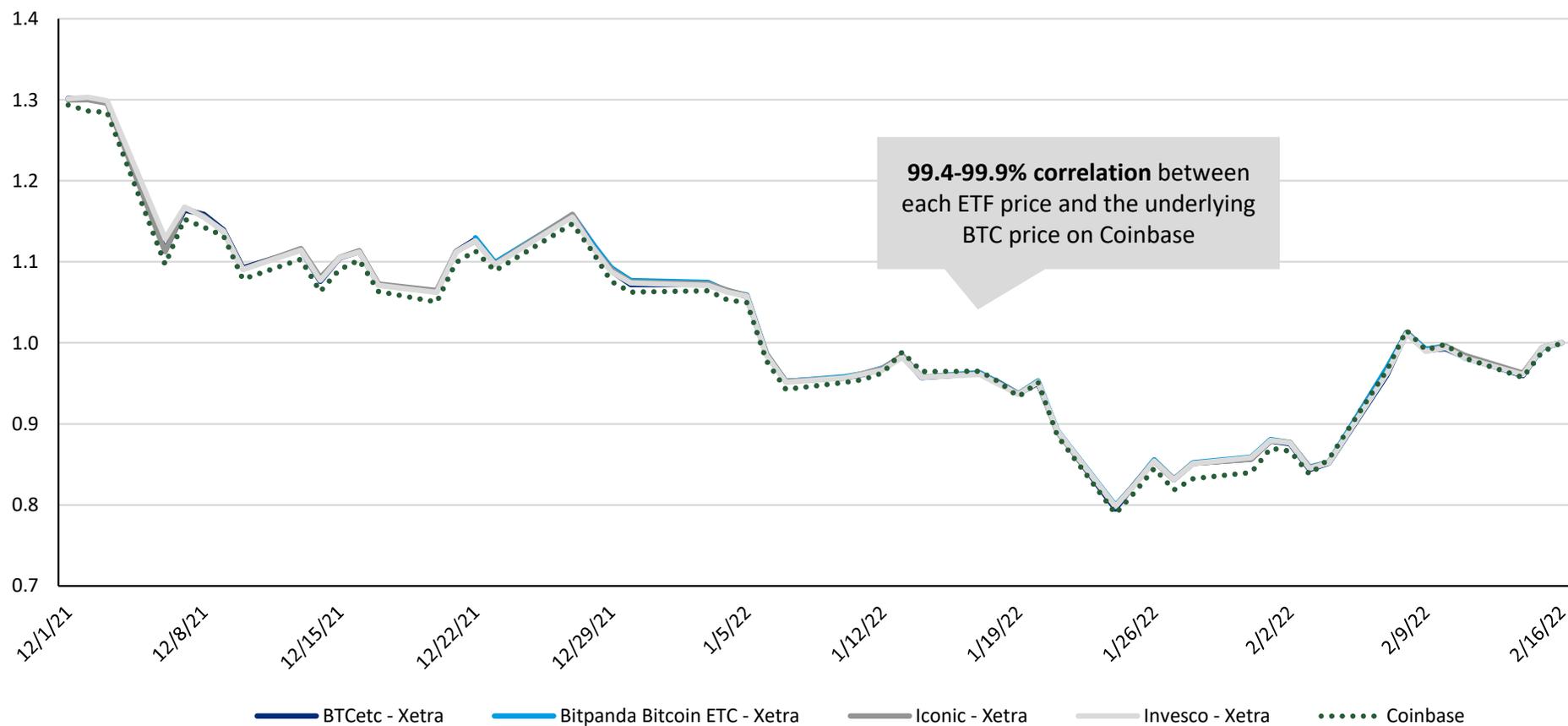
Source: Cryptocompare.com for BTC spot price listed on Coinbase, Xetra and TSX exchanges for BTC ETF prices, Bloomberg for commodity spot and ETF prices

Figure 10: Several other countries have recognized these factors and approved select Bitcoin ETFs

Country	Fund	Exchange
Canada	3iQ Coinshares	<ul style="list-style-type: none"> • TSX
	Purpose Bitcoin	
	CI Galaxy Bitcoin	
	Evolve Bitcoin	
	Ninepoint Bitcoin ETF	
	Fidelity Advantage Bitcoin ETF	
Germany	BTCetc - ETC Group Physical Bitcoin	<ul style="list-style-type: none"> • Xetra (DE)
	Bitpanda Bitcoin ETC	
	Iconic Funds Physical Bitcoin ETP	
	Invesco Physical Bitcoin	
Switzerland	21Shares Bitcoin ETP	<ul style="list-style-type: none"> • Euronext (NL, FR)
Jersey	CoinShares Physical Bitcoin	<ul style="list-style-type: none"> • Xetra (DE)
	WisdomTree Bitcoin	<ul style="list-style-type: none"> • SIX (CH)
Liechtenstein	VanEck Vectors Bitcoin ETN	
Sweden	Bitcoin tracker one	<ul style="list-style-type: none"> • Euronext (SE)
Brazil	QBTC11	<ul style="list-style-type: none"> • B3

Figure 11: German ETFs demonstrate consistent prices with each other and underlying Bitcoin market

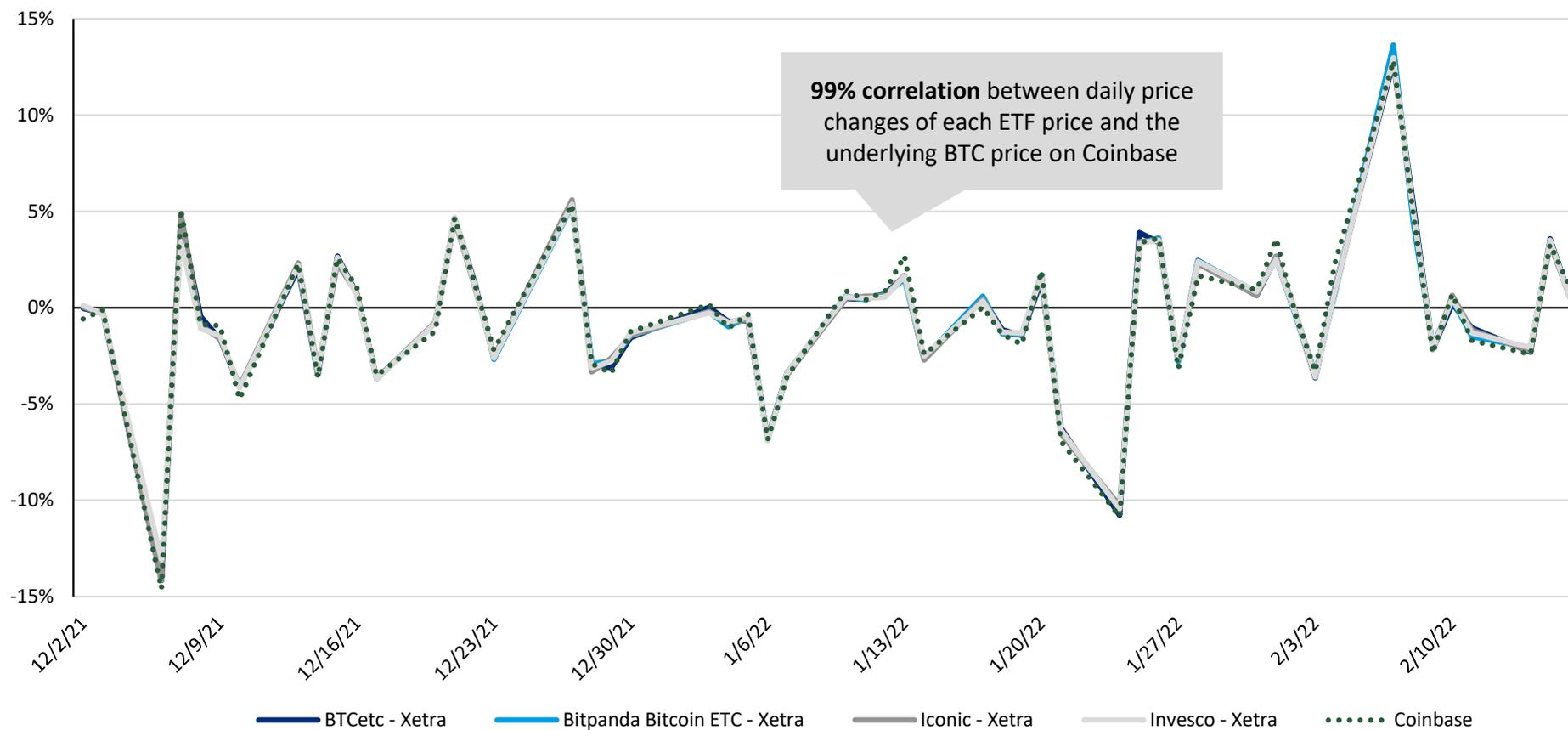
Price of BTC listed on Coinbase vs. Germany ETFs listed on Xetra
9am CET open prices, normalized for comparison¹, 12/1/21 – 2/16/22



1. Given the value of an individual unit of ETF or BTC varies by pricing methodology (1 ETF share represents a fraction of a BTC), prices are normalized by dividing each price by the respective price as of 2/16/22
Source: Cryptocompare.com for Coinbase price, Xetra exchange for ETF prices

Figure 12: Price changes are highly correlated between German ETFs and underlying Bitcoin market

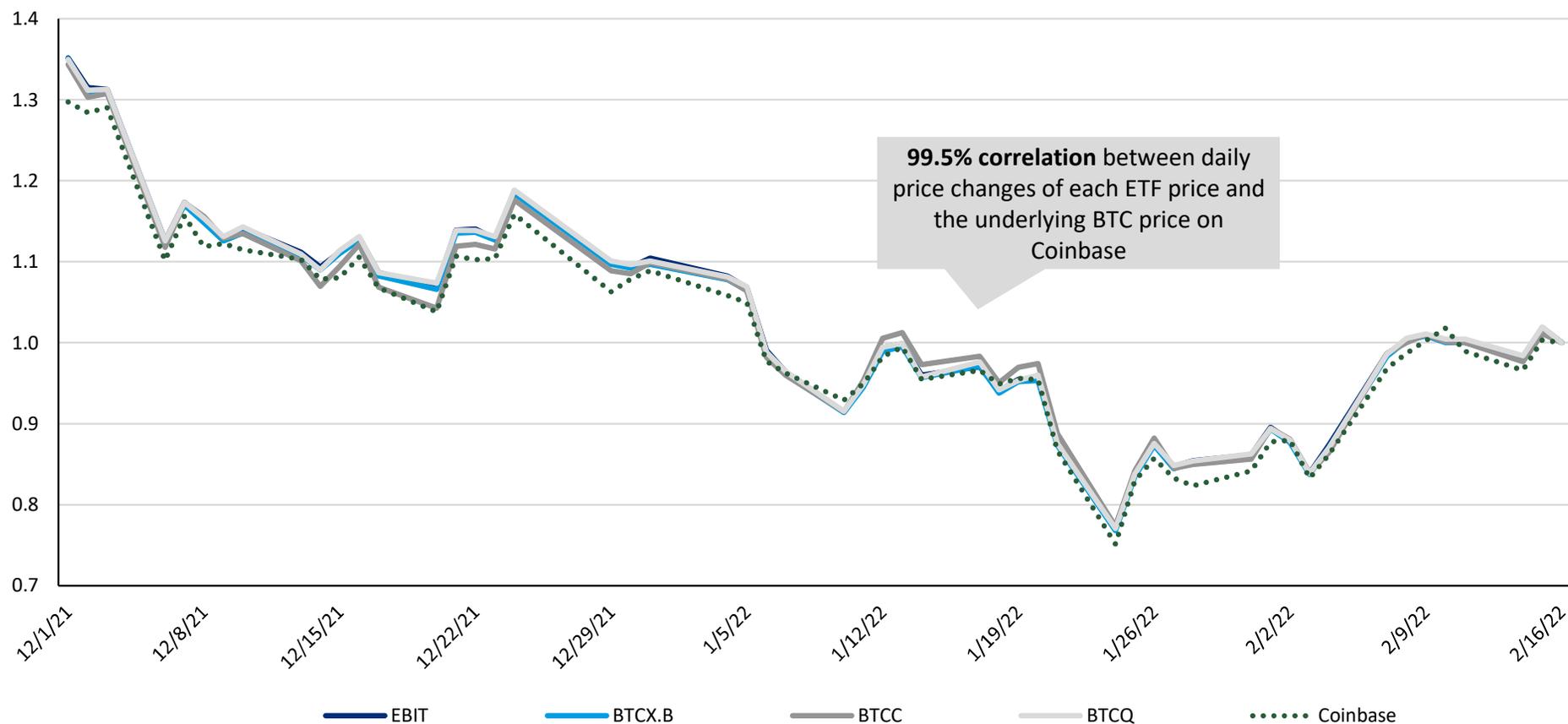
Daily price changes of BTC listed on Coinbase vs. Germany ETFs listed on Xetra
9am CET open prices, 12/1/21 – 2/16/22



Source: Cryptocompare.com for Coinbase price, Xetra exchange for ETF prices

Figure 13: Canadian ETFs demonstrate consistent prices with each other and underlying Bitcoin market

Price of BTC listed on Coinbase vs. Canada ETFs¹ listed on TSX
8am EST open prices, normalized for comparison², 12/1/21 – 2/16/22



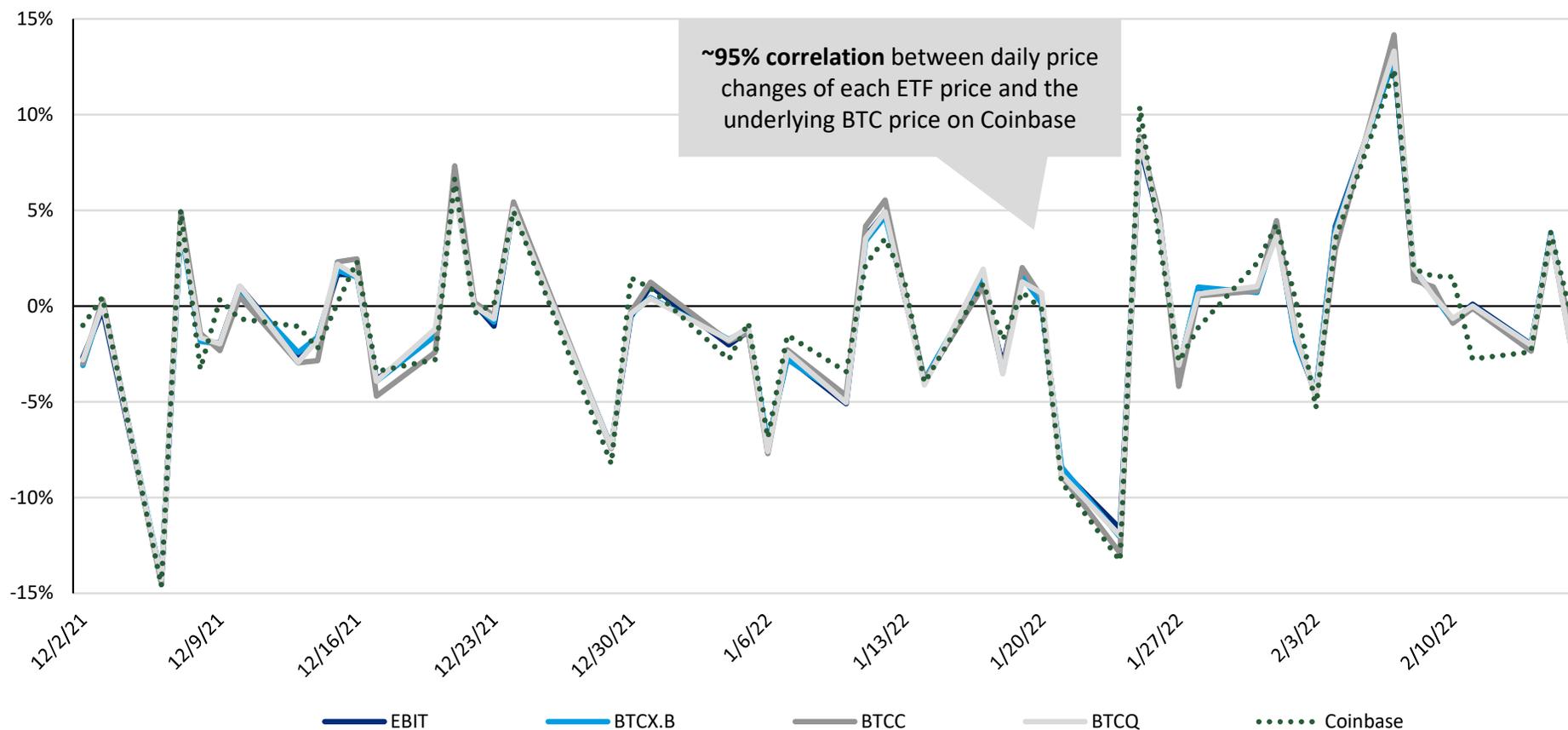
1. 6 ETFs considered: EBIT, BTCX.B, BTCC, BITC, BTCQ, FBTC; FBTC and BITC excluded given significantly lower volumes (each contributing less than 2% of volume across these 6 exchanges over this timeframe)

2. Value of an individual unit of ETF or bitcoin varies by pricing methodology and underlying fees, prices normalized by setting each price as of 2/16 equal to 1

Source: Cryptocompare.com for Coinbase price, TSX exchange for ETF prices

Figure 14: Price changes are highly correlated between Canadian ETFs and underlying Bitcoin market

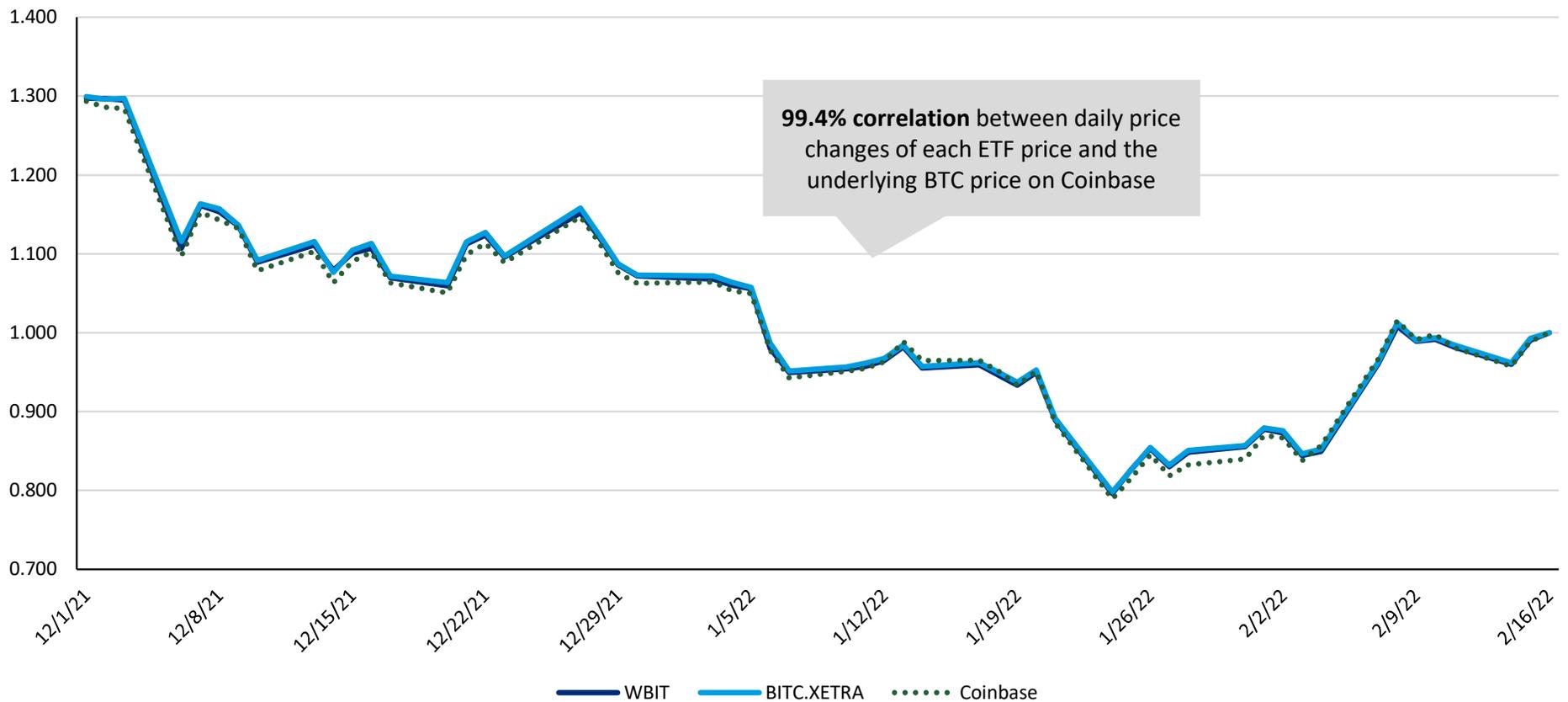
Daily price changes of BTC listed on Coinbase vs. Canada ETFs¹ listed on TSX
8am EST open prices, 12/1/21 – 2/16/22



1. 6 ETFs considered: EBIT, BTCX.B, BTCC, BITC, BTCQ, FBTC; FBTC and BITC excluded given significantly lower volumes (each contributing less than 2% of volume across these 6 exchanges over this timeframe)
Source: Cryptocompare.com for Coinbase price, TSX exchange for ETF prices

Figure 15: Jersey ETFs demonstrate consistent prices with each other and underlying Bitcoin market

Price of BTC listed on Coinbase vs. Jersey ETFs listed on Xetra
9am CET open prices, normalized for comparison¹, 12/1/21 – 2/16/22

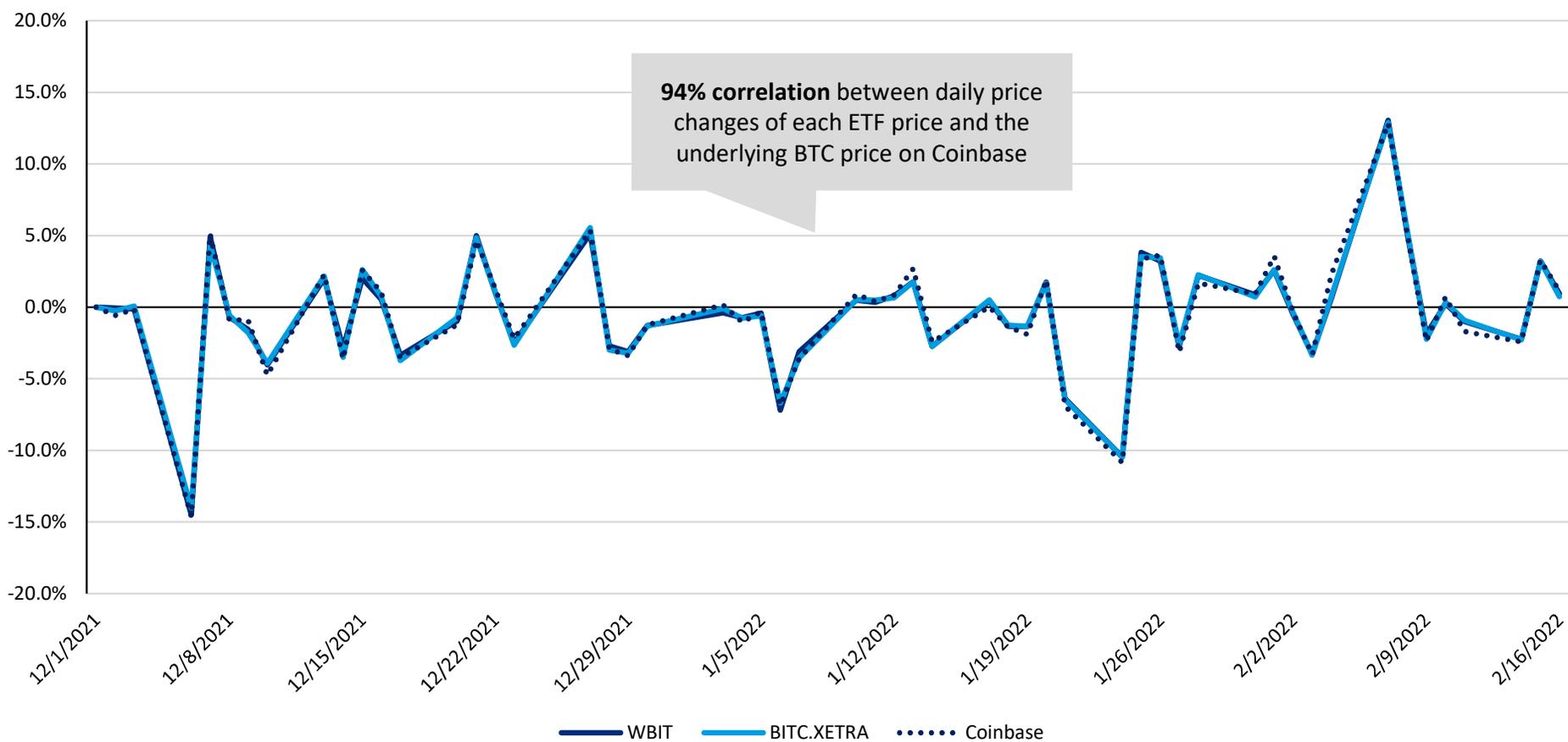


1. Value of an individual unit of ETF or bitcoin varies by pricing methodology and underlying fees, prices normalized by setting each price as of 2/16 equal to 1

Source: Cryptocompare.com for Coinbase price, Xetra exchange for ETF prices

Figure 16: Price changes are highly correlated between Jersey ETFs and underlying Bitcoin market

Daily price changes of BTC listed on Coinbase vs. Jersey ETFs listed on Xetra
9am CET open prices, 12/1/21 – 2/16/22



Source: Cryptocompare.com for Coinbase price, Xetra exchange for ETF prices

Methodology and sources (1/2)

Analysis	Figure	Methodology ¹	Data source
Daily dollar trading volume on BTC spot exchanges	1	<ul style="list-style-type: none"> 30-day rolling average of daily USD trading volume of BTC from exchanges listed on Coinmarketcap, from 1/1/21 to 2/14/22 	<ul style="list-style-type: none"> Yahoo Finance, originally from Coinmarketcap
Average daily dollar volume across Bitcoin exchanges vs. largest S&P 500 stocks	2	<ul style="list-style-type: none"> Average daily trading volume of BTC calculated as simple average of daily trading volume over 2021 (quoted in USD) Average daily USD trading volume of stocks calculated as <i>average daily price * average daily trading volume</i> 	<ul style="list-style-type: none"> BTC daily volume from Yahoo Finance, originally from Coinmarketcap.com Stocks daily volume from Yahoo Finance
Frequency of each level of deviation across 4 exchanges	3	<ul style="list-style-type: none"> BTC spot market price deviations calculated as $(\max(\text{hourly close price across Coinbase, Bitstamp, Kraken and Lmax}) - \min(\text{hourly close price across Coinbase, Bitstamp, Kraken and Lmax})) \div (\text{volume weighted average BTC price across Coinbase, Bitstamp, Kraken and Lmax})$ for each hour from 12/8/18 to 2/15/22 	<ul style="list-style-type: none"> BTC spot prices for every exchange from Cryptocompare
Price deviation across exchanges for BTC spot market and select dual-listed stocks	4	<ul style="list-style-type: none"> BTC spot market deviations calculated as defined above Dual-listed stock price deviations are the hourly USD price difference between securities listed on 2 exchanges, calculated as $\text{abs}(\text{price}_{t, \text{Exchange A}} \div \text{price}_{t, \text{Exchange B}} - 1)$ for each hour t from 1/10/22 to 2/23/22 Only trading hours during which both exchanges trade are considered within the scope of this analysis Required currency conversion where exchanges are not originally USD denominated 	<ul style="list-style-type: none"> BTC spot prices from Cryptocompare Stock prices and USD conversion rates from Bloomberg
Bitcoin price across 4 exchanges	5	<ul style="list-style-type: none"> BTC hourly closing prices across Coinbase, Bitstamp, Kraken and Lmax from 3/12/20 to 3/13/20 	<ul style="list-style-type: none"> BTC spot prices from Cryptocompare
Daily price for BTC futures and spot markets	6	<ul style="list-style-type: none"> Daily closing prices for BTC CME futures and Coinbase spot market, from 11/4/21 to 2/23/22 	<ul style="list-style-type: none"> BTC CME futures from Bloomberg BTC spot prices from Cryptocompare, originally from Coinbase
Daily percentage change in trading volume for BTC futures and spot markets	7	<ul style="list-style-type: none"> Changes in daily volume for BTC CME futures and Coinbase spot market calculated as $(\text{trading volume}_t \div \text{trading volume}_{t-1} - 1)$ for each day t from 11/30/21 – 2/23/22 	<ul style="list-style-type: none"> BTC CME futures from Bloomberg BTC spot prices from Cryptocompare, originally from Coinbase

1. Missing data points during the period of analysis are ignored.

Methodology and sources (2/2)

Analysis	Figure	Methodology ¹	Data source
Market capitalization of BTC and commodities	8	<ul style="list-style-type: none"> Total USD market capitalization as of 2/15/22 	<ul style="list-style-type: none"> BTC market capitalization from Coinmarketcap Commodities market capitalization from companiesmarketcap.com
Average absolute difference in daily return for commodity and Bitcoin ETFs vs. spot markets	9	<ul style="list-style-type: none"> Commodity spot and ETFs daily returns for day t calculated as $(close\ price_t \div close\ price_{t-1} - 1)$ BTC spot and ETFs daily returns for day t calculated as $(open\ price_t \div open\ price_{t-1} - 1)$. Canadian and German ETF open prices compared with the corresponding spot hourly prices from Coinbase Average absolute difference in daily returns calculated as the <i>average</i>_{Over all days t} $(abs(daily\ return_{t,ETF} - daily\ return_{t,spot}))$ where t represents each day in the period 1/14/22 to 2/16/22 	<ul style="list-style-type: none"> Commodity spot markets and ETF prices from Bloomberg BTC ETF prices from Toronto Stock Exchange (BTCC) and Frankfurt Stock Exchange (21Shares Bitcoin)
Price of BTC listed on Coinbase vs. ETFs	11, 13, 15	<ul style="list-style-type: none"> Given the value of an individual unit of ETF or BTC varies by pricing methodology (e.g. 1 ETF share represents only a fraction of a BTC), prices are normalized by dividing each price by the respective price as of 2/16/22 As noted above, daily price is based off open prices for the ETF exchange and the corresponding hourly spot price from Coinbase 	<ul style="list-style-type: none"> BTC prices from Cryptocompare German and Jersey ETF prices from Frankfurt Stock Exchange (Xetra) Canadian ETF prices from Toronto Stock Exchange
Daily price changes of BTC listed on Coinbase vs. ETFs	12, 14, 16	<ul style="list-style-type: none"> Daily price changes are calculated as $(price_t \div price_{t-1} - 1)$ for day t from 12/1/21 to 2/16/22 As noted above, daily price is based off open prices for the ETF exchange and the corresponding hourly spot price from Coinbase 	<ul style="list-style-type: none"> BTC prices from Cryptocompare German and Jersey ETF prices from Frankfurt Stock Exchange (Xetra) Canadian ETF prices from Toronto Stock Exchange

1. Missing data points during the period of analysis are ignored.