



May 25, 2022

VIA ELECTRONIC DELIVERY

Ms. Vanessa A. Countryman
Secretary
U.S. Securities and Exchange Commission
100 F Street, NE
Washington, DC 20549-1090

RE: Notice of Filing of 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.: 34-93504

Dear Ms. Countryman:

My name is Professor Robert E. Whaley. I'm an established expert in derivative contract valuation and risk management, and market operation. I've been a consultant for many major investment houses, security (futures, option and stock) exchanges, governmental agencies, and accounting and law firms. I developed the CBOE Market Volatility Index (i.e., the "VIX") for the Chicago Board Options Exchange in 1993, the NASDAQ Market Volatility Index (i.e., the "VXN") in 2000, and the BuyWrite Monthly Index (i.e., the "BXM") in 2001, and co-developed the NASDAQ OMX Alpha Indexes. I'm currently a Valere Blair Potter Professor of Management (Finance) Director, Financial Markets Research Center at the Vanderbilt University Owen Graduate School of Management.

This letter provides my perspective on why the NYSE Arca's application to list and trade shares of Grayscale Bitcoin Trust (BTC) ("GBTC") under NYSE Arca Rule 8.201-E as a spot bitcoin ETP should be approved by the Securities Exchange Commission (the "Commission"). My views are based on 40 years of research and teaching in financial markets.

Bitcoin is a new asset class. Its usefulness arises from the fact that its returns are relatively uncorrelated with traditional asset classes like stocks and bonds, thereby providing more efficient return-risk opportunity. Bitcoin ETPs are an effective mechanism for investing in bitcoin. Public demand for such investment tools is evidenced by the launch of ProShares bitcoin futures-based ETF (BITO) in October 2021. In its first

day of trading, its assets under management (AUM) reached more than \$1B,¹ one of the most successful product launches in the 30-year ETP history. However, as further described below, futures-based bitcoin ETFs like BITO are a much more costly and inefficient way for investors to access bitcoin compared to what would be a more transparent and well-designed spot-based bitcoin ETP like GBTC. And because the Commission has already approved futures-based bitcoin ETFs, it must implicitly be comfortable with a spot-based bitcoin ETP like GBTC.

My comments in support of the NYSE Arca application fall into three main categories: (a) index construction, (b) market depth and liquidity, and (c) product design. Wherever possible, I support my opinions using publicly available data.

Index construction

Two bitcoin indexes are relevant to this discussion: the CME CF Bitcoin Reference Rate (BRR) that underlies the CME's bitcoin futures contract and the CoinDesk Bitcoin Price Index (XBX) that underlies GBTC described in the NYSE application. Since the Commission has approved the trading of BITO, BRR has an implicit acceptance as a bitcoin benchmark; and as described further below, so too should XBX from the Commission's perspective.

In my opinion, the key issue is whether XBX performs differently than BRR. Both are based on volume-weighted prices and have overlapping constituent exchanges. XBX has used prices exclusively from select exchanges over its history and currently uses price from Coinbase Pro, Bitstamp, Kraken, and LMAX Corporation. BRR currently uses prices from Coinbase, Bitstamp, itBit, Kraken, and Gemini.²

To address this issue, I gathered daily index levels for the period beginning January 4, 2021 (about ten months before the launch of BITO) through present (about six months after product launch). XBX was sourced from CoinDesk Indices, Inc. and BRR was sourced from Bloomberg. Summary statistics for the 338 daily natural logarithm (\ln) returns are reported below in Table 1. XBX has a higher daily average return than BRR (0.0382% vs 0.0356%), but the difference is not significant in a statistical sense. Both return distributions are slightly negatively skewed but not different from one another. Both return series show negative first-order autocorrelation, however, the level is not significantly different from 0. In other words, prices have no memory as one expects in an efficient marketplace. XBX has a lower annualized standard deviation of return (i.e., "volatility") than BRR (79.38% vs 80.31%), but the difference is not meaningful economically or statistically. In summary, XBX and BRR are near perfect substitutes for

¹ Other futures-based ETFs were also launched, however, BITO has enjoyed a first-mover advantage and dominates other futures-based bitcoin products.

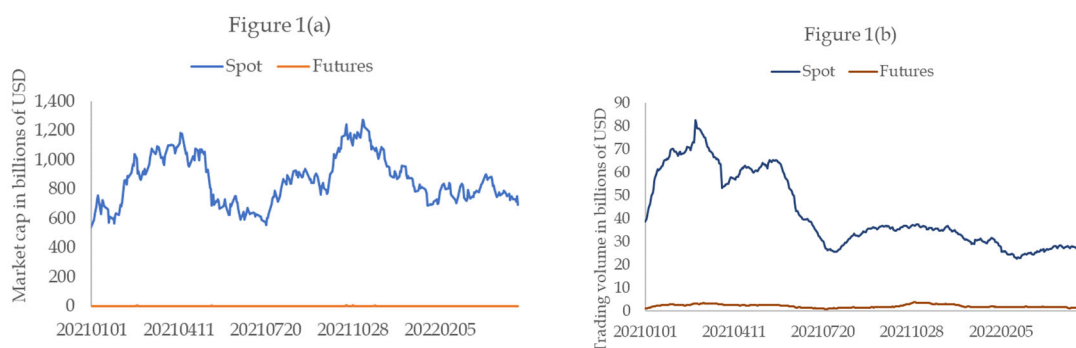
² CME CF Cryptocurrency Pricing Products, (undated) *Constituent Exchanges List* (p. 3).

the sample period.

Table 1: Summary statistics		
Description	XBX	BRR
<i>n</i>	338	338
Mean (daily)	0.000382	0.000356
StDev (daily)	0.050007	0.050593
Skewness	-0.395406	-0.273866
Autocorrelation	-0.069047	-0.061288
Minimum	-0.259781	-0.231823
Median	-0.001246	-0.001219
Maximum	0.165069	0.166328
Mean (annual)	9.63%	8.96%
StDev (annual)	79.38%	80.31%
Correlation	0.983	

Market depth and liquidity

Issues of market depth and liquidity are relevant in discussions of possible market manipulation. BITO is based on the CME's bitcoin futures market and launched in October 2021 based on Commission approval. The application by NYSE Arca for trading of GBTC is based on the bitcoin spot market. Daily data for total USD market cap and trading volume across all bitcoin exchanges worldwide was obtained from Coin Market Cap. Dollar open interest and trading volume for the CME's bitcoin futures was obtained from CME Group Datamine. The investigation period is the same as before – January 4, 2021, through present. The comparison one-sided as Figures 1(a) and 1(b) below show. In terms of USD value, the market cap in the CME's bitcoin futures market averages less than one-quarter of one percent of the bitcoin spot market. The dollar trading volume of bitcoin futures averages about 5.5%. Since the Commission is comfortable with the viability of futures-based ETF investing in an environment in which the spot market dominates (in terms of both dollar value and trading volume), it follows logically that spot-based ETPs are warranted.



Product design

In my view, the financial payoffs of investments need to be well-defined. In the case of futures-based bitcoin ETFs like BITO and spot-based bitcoin ETPs like what GBTC would be, both products should be defined as tracking the price of bitcoin. The GBTC ETP price is inextricably linked to the price of bitcoin because it holds actual bitcoin. The conversion/redemption arbitrage process will ensure it. There is no equivalent claim that can be made for the futures-based bitcoin ETFs, however. ProShares BITO, for example, does not have a stated benchmark index which defines its replication bitcoin trading strategy. In the case of the VIXY ETF, ProShares say

“ProShares VIX Short-Term Futures ETF provides long exposure to the S&P 500 VIX Short-Term Futures Index, which measures the returns of a portfolio of monthly VIX futures contracts with a weighted average of one month to expiration.”

This implies that to mimic the index the issuer rolls a small fraction of the nearby futures contract investment into the second nearby contract to maintain a constant one-month maturity.³ In contrast, the BITO Fact Sheet says only that it is a U.S. bitcoin-linked ETF designed

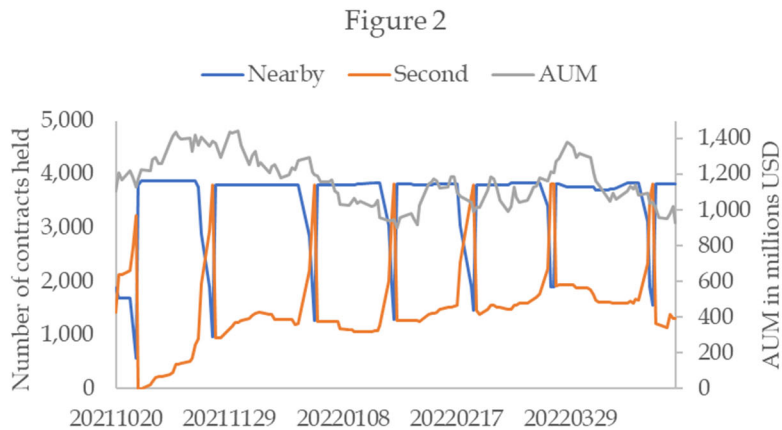
“... to provide investment results that generally correspond to the performance of bitcoin... primarily through managed exposure to bitcoin futures contracts...”,

which provides little guidance on what futures trading occurs.

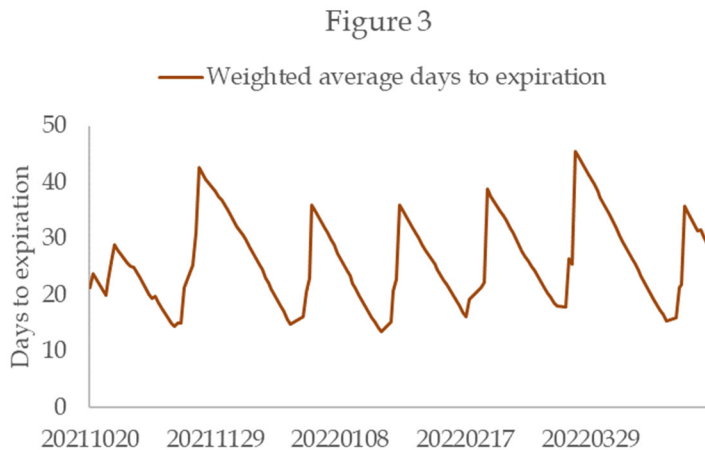
To learn about ProShares actual futures trading, I examine the daily holdings of BITO published on the ProShares website. Figure 2 was prepared from daily futures holding data for BITO from product launch through May 5, 2022 through present. During the sample period, BITO held only the two nearby bitcoin futures. The nature of the figure suggests that ProShares holds as much as the nearby futures contract that they are

³ The precise calculations are illustrated for VIXY in Colby J. Pessina and Robert E. Whaley, Levered and inverse exchange-traded products, *Financial Analysts Journal* (2021, Table 6, p. 14).

permitted given the CME’s position limit of 4,000 contracts. Any residual need to contracts needed with net inflows on a given day are then met with purchases of the second nearby. Once the nearby futures reach a week or so to expiration, ProShares appears to roll out of the nearby into the second nearby over a period of three or four days. Notably, spot-based ETPs have no such roll purchases because they hold the actual underlying asset.

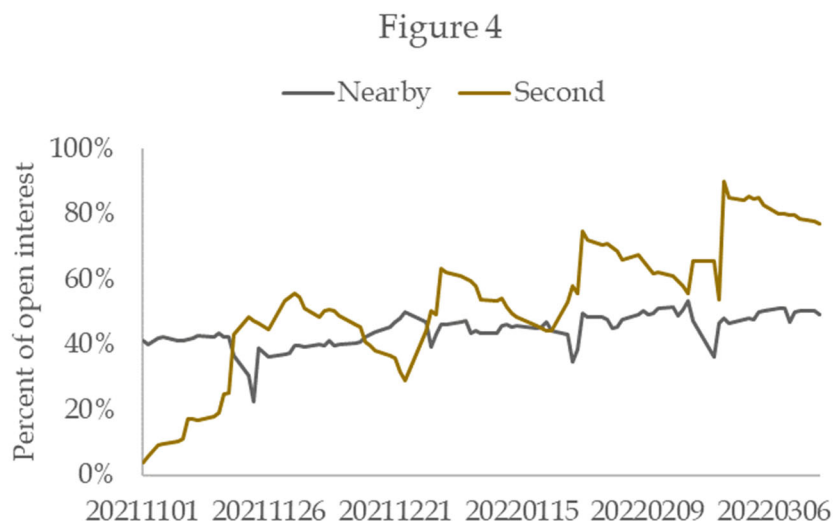


Another way of viewing this trading pattern is to examine the weighted average of the time to maturity of the futures position through time. Recall that for VIXY the time is one month and would be represented by a horizontal in Figure 3 below. Instead, a saw-tooth pattern appears, presumably necessary because of higher liquidity in the nearest term contract.



The BITO holdings data are also useful in addressing the market depth issue discussed earlier. Recall Figures 1(a) and 1(b) demonstrated how deep and liquid the

bitcoin spot market was relative to the bitcoin futures market. An interesting question to ask is what proportion of the nearby and second nearby BITO futures open interest is accounted for by BITO's \$AUM. Figure 4 below summarizes. BITO appears to hold about 40% of the total open interest of the nearby bitcoin futures at any point in time. The proportion held in the second nearby is higher and has been increasing through time.



The issue of product design also involves understanding any inherent flaws in the replication strategy that inhibit its performance. In futures and spot markets where active arbitrage occurs continuously through time, the cost of carry relation holds. This implies that the return of a fully collateralized bitcoin futures position should be equal to the return of spot bitcoin. The bitcoin futures usually trade above their cost of carry level—a condition called contango. This implies that the rate of return on a fully collateralized futures position like that of BITO will be less than the return on the underlying asset as the futures price converges to the underlying asset price through time. The steeper the futures price curve, the greater the return differential. As previously noted, spot-based ETPs have no such roll costs because they hold the actual underlying asset. As a result, GBTC would not suffer from the additional costs caused by contango.

To see this in action, I consider the hypothetical performance of spot- and futures-based ETFs over our sample period. XBX will represent the return of GBTC before expenses. SPBTCFUT is a bitcoin futures-based index that tracks the total return of a collateralized bitcoin futures strategy very similar to that of BITO before expenses. Specifically, SPBTCFUT holds the nearby futures until five days before expiration and then rolls from the nearby to the second nearby daily in 20% increments.⁴ Table 2 contains the summary statistics from the daily return analysis. The effects of contango are immediately evident. Since January 4, 2021, the holding period return (HPR) of XBX has

⁴ Standard and Poor's, *S&P Futures Indices: Methodology* (May 2022).

been more than 9% higher than SPBTCFUT (15.13% vs 6.11%) at a slightly lower level of risk (72.09% vs 74.15%). The dominance of the spot bitcoin investment on a risk-adjusted performance basis can be expected to persist through time if the bitcoin futures market remains in contango.⁵

Table 2: Summary statistics		
Description	XBX	SPBTCFUT
<i>n</i>	338	338
Mean (daily)	0.0004	0.0002
StDev (daily)	0.0454	0.0467
Skewness	0.0223	0.0529
Autocorrelation	-0.0371	-0.0523
Minimum	-0.1589	-0.1569
Median	0.0014	0.0012
Maximum	0.1986	0.2015
Mean (annual)	10.50%	4.42%
StDev (annual)	72.09%	74.15%
CAGR	11.08%	4.52%
HPR	15.13%	6.11%
Correlation	0.999	

The reason that SPBTCFUT rather than BITO is used in the analysis of Table 2 is that it has a longer history. Currently, BITO has less than six months of daily return observations. Nevertheless, in the interest of completeness, it is important to document the daily return relation between BITO and SPBTCFUT in the time since BITO launch. Table 3 contains the results. BITO and SPBTCFUT are virtually perfect substitutes. The only meaningful difference is in the CAGR, which is 0.86% lower for BITO. BITO's expense ratio is 0.95%.

⁵ This effect has also been documented for other futures-based products.

Table 3: Summary statistics		
Description	BITO	SPBTCFUT
<i>n</i>	136	136
Mean (daily)	-0.0048	-0.0047
StDev (daily)	0.0392	0.0391
Skewness	0.1417	0.1265
Autocorrelation	0.0033	0.0004
Minimum	-0.1099	-0.1112
Median	-0.0042	-0.0047
Maximum	0.1125	0.1139
Mean (annual)	-120.31%	-117.50%
StDev (annual)	62.24%	62.03%
CAGR	-69.97%	-69.12%
HPR	-47.76%	-46.96%
Correlation	0.999	

Summary and recommendation

The three key elements that cause me to strongly endorse the NYSE Arca application to list and trade shares of GBTC under NYSE Arca Rule 8.201-E as a spot bitcoin ETP are: (a) the XBX bitcoin index that GBTC is priced on is virtually a perfect substitute for the BRR index that underlies the return-risk exposure for the futures-based ETFs that the Commission has already approved, (b) the bitcoin spot market is vastly deeper and more liquid than the bitcoin futures market, and (c) the product structure is much more transparent and well-designed.

Thank you for your consideration.



Robert E. Whaley
 Valere Blair Potter Professor Finance, and
 Director, Financial Markets Research Center
 Vanderbilt University