cfbenchmarks

Comments on NYSE ARCA Proposed Rule Changes – SEC

October 2019

These comments are submitted to the SEC as part of its solicitation of comments for the consideration of NYSE Arca's proposed rule change (SR-NYSEArca-2019-39) in regards to the potential listing of the Wilshire Phoenix Trust. CF Benchmarks is a Registered Benchmark Administrator authorised and regulated by the UK FCA. It is the Administrator of the CME CF BRR that the SEC is seeking comments on.

What are commenters' views of the Exchange's assertion that the "proper 'market' that one should evaluate to determine whether the 'market' is inherently resistant to manipulation is the segment of the market formed by the Constituent Platforms"?

The CME CF BRR measures the economic reality of the exchange of Bitcoins for U.S. Dollars. The Exchange proposes to list the Trust that will have holdings in Bitcoin. Shares in the Trust will be priced and purchased in US Dollars. The valuation of the Trust will be denominated in US Dollars. ***Inter alia*** as long as the operators of the trust only transact in Bitcoin–USD markets for the purposes of purchasing Bitcoins on behalf of the Trust then the Trust will only be operating in the Bitcoin-USD market and thus for the purposes of the Trust then the assertion is correct.

What are commenters' views of the Exchange's conclusion that, while bitcoin is listed and traded on a number of markets and platforms, the CME CF BRR exclusively utilizes its Constituent Platforms to determine the value of the CME CF BRR, and therefore, use of the CME CF BRR would mitigate the effects of potential manipulation of the bitcoin market?

The CME CF BRR measures the economic reality of the USD price of Bitcoins by observing the exchange of Bitcoins for U.S. Dollars. This is done by exclusively utilising transaction data in the trading pair of Bitcoin-USD observed from Constituent Platforms (at time of writing these are Coinbase, Bitstamp, itBit, Gemini and Kraken). This is an important distinction between the pricing benchmarks provided by CF Benchmarks and other providers. CF Benchmarks does not utilise input data other than that which ***reflects the economic reality it seeks to measure.*** This means that the CME CF BRR **does not** utilise transactions conducted in parallel markets such as Bitcoin against so called "stablecoins" (Tether, GUSD, USDC etc) or other cryptocurrencies (such as Ether) as input data.

Given this characteristic of the CME CF BRR it is clear that only manipulation of the Bitcoin-U.S. Dollar markets operated by the constituent platforms can impact the integrity of the CME CF BRR. As the Bitcoin-U.S Dollar markets require traditional banking operators to facilitate the

deposit or withdrawal of U.S. Dollars from constituent platforms and that this facilitation requires disclosure of personal information by users there exists the ability to identify the individuals associated to any transaction. This would clearly act as a deterrent against manipulation that would likely be absent where alternative trading pairs that utilise stablecoins and other cryptocurrencies are utilised as input data to the calculations.

The Exchanges conclusion that "***use of the CME CF BRR would mitigate the effects of potential manipulation of the bitcoin market***" is therefore correct as use of an alternative index or other pricing source would likely incorporate a wider set of markets and trading pairs that would not give the traceability that the BRR offers.

Additionally, what are commenters' views of the Exchange's assertion that the capital necessary to maintain a significant presence on any Constituent Platform would make manipulation of the CME CF BRR unlikely?

The CME CF BRR is calculated by observing the transactions conducted on constituent exchanges during a one-hour observation window (1500 to 1600 London Time). This time was specifically chosen as the most liquid period for Bitcoin – U.S. Dollar trading, being a period where the majority of both the European and US investors will be trading on the constituent platforms. In the period during from January 2018 to the end of September 2019 the CME CF BRR has observed average trading volume of $13M during the observation window*

The CME CF BRR methodology divides the observation window into twelve discrete five-minute partitions. The calculation then has two key steps:

1. The volume weighted median of the transactions observed in each five-minute partition is calculated.
2. The CME CF BRR is then given by the arithmetic mean of the twelve volume weighted medians.

This means that certain types of manipulative trading would have little or no impact on the level of the CME CF BRR:

- ***A single large volume trade placed during the window***
    - Any influence on the CME CF BRR level would be confined to one partition the averaging process in step 2 would nullify its influence due to each partitions contribution to the CME CF BRR level being through a volume weighted median in step 1
- ***12 large volume trades placed in each five-minute partition during the observation window***

- Although influencing all partitions the use of the volume weighted median in step 1 would nullify the influence of each trade. The averaging effect in step 2 would then further nullify the influence of these trades.

To be sure of having any impact on any individual partition a trader must first at a minimum be responsible for more than 50% of the aggregate volume across all constituent platforms (due to the usage of volume weighted medians) in any five-minute partition. Then due to step 2 of the methodology and the averaging effect that it would produce the trader must maintain this presence for at least 35 minutes (7 of the 12 partitions) to have any impact to the CME CF BRR. This would on average involve capital of $3.8M.

However, to be sure of having any ***meaningful*** impact on the volume weighted median of any individual partition a trader must attempt to be responsible for more than 50% of the volume for that partition through trades executed at a ***significant deviation to prevailing price.*** It is not known what the cost of this might be, but it is likely to require a multiple of the average volume observed in any five-minute partition ($1.1M). To then have any ***meaningful*** impact on the CME CF BRR a trader would have to do this for 45 minutes (9 of the 12 partitions) to overcome the averaging effect of step 2 of the methodology. It would therefore be reasonable to think that the capital required would likely be upwards of $20M. However, the presence of arbitrageurs operating across the constituent platforms would likely mean that this amount would increase significantly the greater the degree of impact a manipulator was seeking to make.

The Exchanges' assertion that the capital necessary to maintain a significant presence on any Constituent Platform would make manipulation of the CME CF BRR unlikely is partially correct. More accurately the "significant presence" would have to be maintained across all constituent platforms.

What are commenters' views of the Exchange's assertion that the CME CF BRR is not susceptible to manipulation?

All benchmarks are susceptible to manipulation. The assessment that needs to be made is:

1. To what degree is a benchmark susceptible to manipulation and how?
2. Has the administrator conducted an analysis of this and incorporated necessary methodological safeguards to promote manipulation resistance?
3. Does the administrator maintain documented policies and procedures to monitor for the aspects of the index calculation that are identified as potentially susceptible to manipulation and what are the consequences of such manipulation?

Susceptibility

As the CME CF BRR does utilise transaction data in its benchmarks, there is potential for market participants to attempt to manipulate the benchmark by conducting transactions at prices that are at variance to prevailing prices on the exchange platforms that are input data sources for the benchmarks.

Manipulation Resistance by Methodology Design

The design of the CME CF BRR methodology has specifically taken manipulation resistance into account. The methodologies take an observation window and divide it into equal partitions of time. The volume weighted median of all transactions within a partition is then calculated for that partition. The arithmetic mean, of the volume weighted medians, equally weighted, is then the benchmark value. This has the below benefits in relation to manipulation resistance.

Usage of partitions

Individual trades of large size have limited effect on the benchmark level as they only influence the level of the volume weighted median for that specific partition.

A cluster of trades in a short period of time will also only influence the volume weighted median of the partition or partitions they were conducted in.

Usage of volume weighted medians

The usage of volume weighted medians as opposed to volume weighted means ensures that transactions conducted at outlier prices do not have an undue effect on the value utilised for a specific partition.

Equal weighting of partitions

By not volume weighting partitions, trades of large size or clusters of trades in a short time period will not have an undue influence on the benchmark level.

Equal Weighting of Constituent Platforms

CF Benchmarks applies equal weight to the transactions observed from constituent platforms. With no pre-set weights potential manipulators cannot target one platform for the conduct of manipulative trades

Utilising the arithmetic mean of partitions

Using the arithmetic mean of partitions of equal weight this further denudes the effect of trades of large size at prices that deviate from the prevailing price having undue influence on the benchmark level.

For further detailed analysis of the above manipulation resistance characteristics please see Appendix I- Paine & Knottenbelt ***"Analysis of the CME CF Bitcoin Reference Rate and CME CF Bitcoin Real Time Index"*** (Imperial College Centre for Cryptocurrency Research, November 2016).

Manipulation Resistance by the Exclusion of Input Data

CF Benchmarks methodologies that utilise transaction data as input data contain specific ***potentially erroneous data*** provisions

Although the volume weighted median of transaction prices from an individual data source are not a part of the benchmark determination process, they are calculated as a means of quality control and manipulation resistance

For each and every calculation of the CME CF BRR where any constituent platform exhibits a volume weighted median for transactions during the observation window of absolute percentage deviation greater than the ***potentially erroneous data parameter*** (15% for the CME CF BRR) from the median of volume weighted medians observed from the other constituent platforms then the transactions from that constituent platform are deemed to be ***potentially erroneous*** and excluded from the benchmark calculation

All instances of potentially erroneous data are flagged to the CME CF Oversight Committee and also trigger CF Benchmarks Internal benchmark monitoring processes.

Monitoring

Although a series of measures have been taken to mitigate against benchmark manipulation through the methodology described above, CF Benchmarks remains vigilant to any attempted benchmark manipulation through this method and monitors the input data it utilises continuously. Any cases of suspected benchmark manipulation are escalated through the appropriate regulatory channels in accordance with its obligations under EU BMR.

What are commenters' views of the Exchange's arguments that substantially similar price discovery and degrees of price volatility among each of the Constituent Platforms

The CME CF BRR aggregates trades observed on Constituent Platform during a one-hour observation window between 1500 and 1600 London Time. As part of the Administrators benchmark monitoring it undertakes a number of shadow calculations, one of which is to recompute the CME CF BRR without the participation of each of the Constituent Platforms. This metric gives a strong indication of how closely the Constituent Platforms track each other in terms of price per unit of volume transacted. In the period from January 2018 to September 2019* the variance exhibited has been:

Constituent Platform Omitted	Average Variance %	Greatest Variance %
Bitstamp	0.005	1.079
Coinbase	0.008	0.869
itBit	0.000	0.049
Kraken	0.002	0.151

This analysis would seem to support the Exchanges arguments that substantially similar price discovery is exhibited among each of the Constituent Platforms.

When an analysis is undertaken of the pair wise correlation of prices observed from the Constituent Platforms on a per minute basis (by utilising the price variation of the last transaction for each minute from each Constituent Platform) during the observation window of the CME CF BRR over the previous 12 months then we see the below results.

Constituent Platform Pair	Mean Correlation %	Median Correlation %
Bitstamp - Coinbase	90.57	94.71
Bitstamp - Kraken	87.30	92.40
Bitstamp - itBit	85.45	90.25
Coinbase - Kraken	90.72	94.73
Coinbase - itBit	88.67	93.10
itBit - Kraken	88.06	93.63

This indicates that correlation is very strong so supports the Exchanges view that degrees of price volatility are substantially similar.What are commenters' views on the Exchange's assertion that, because the CME CF BRR is calculated based solely on the price data from the Constituent Platforms, manipulating the CME CF BRR must necessarily entail manipulating the price data at one or more Constituent Platforms and that anyone attempting to manipulate the Trust would need to place numerous large sized trades on any of the Constituent Platforms that are used to calculate the CME CF BRR?

The CME CF BRR is calculated by observing the transactions conducted on constituent exchanges during a one-hour observation window (1500 to 1600 London Time). This time was specifically chosen as the most liquid period for Bitcoin – U.S. Dollar trading being a period where the majority of both the European and US investors will be trading on the constituent platforms. In the period during from January 2018 to the end of September 2019 the CME CF BRR has observed average trading volume of $13M during the observation window.

*Gemini has been omitted from this analysis as it has only been a Constituent Platform since August 30th 2019

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Although influencing all partitions, the use of the volume weighted median in step 1 would nullify the influence of individual trades. The averaging effect in step 2 would then further nullify the influence of these trades. To be sure of having any impact on any individual partition a trader must first at a minimum be responsible for more than 50% of the aggregate volume across all constituent platforms (due to

the usage of volume weighted medians) in any five-minute partition. Then due to step 2 of the methodology and the averaging effect that it would produce, the trader must maintain this presence for at least 35 minutes (7 of the 12 partitions) to have any impact to the CME CF BRR. This would on average involve capital of $3.8M.

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operating across the constituent platforms would likely mean that this amount would increase significantly the greater the degree of impact a manipulator was seeking to make.

What are commenters' views on the Exchange's argument that, if an attempt were made to manipulate the Trust, the administrator for the CME CF BRR and the CME would be able to detect the manipulative trading patterns?

CF Benchmarks is authorised and regulated by the FCA under EU BMR. CF Benchmarks has in place mechanisms, policies, processes and procedures to be able to fulfil its regulatory obligations. Under EU BMR there are specific provisions regarding benchmark manipulation - ***Article 14 (Reporting of Infringements)*** of EU BMR states:

1. An administrator shall establish adequate systems and effective controls to ensure the integrity of input data in order to be able to identify and report to the competent authority any conduct that may involve manipulation or attempted manipulation of a benchmark, under Regulation (EU) No 596/2014.

2. An administrator shall monitor input data and contributors in order to be able to notify the competent authority and provide all relevant information where the administrator suspects that, in relation to a benchmark, any conduct has taken place that may involve manipulation or attempted manipulation of the benchmark, under Regulation (EU) No 596/2014, including collusion to do so."

The Exchange's argument that if an attempt were made to manipulate the Trust, the administrator for the CME CF BRR, and the CME would be able to detect the manipulative trading pattern can only be partially supported. Whilst the Administrator will be able to detect manipulative trading patterns that are attempting to manipulate the CME CF BRR it does not follow that the Administrator could necessarily detect trading attempting to manipulate the Trust. The Trust can potentially be manipulated in a number of ways that are unrelated to the CME CF BRR, it will hold not just Bitcoins but other assets and will be traded on the Exchange – both potential routes to manipulation that the Administrator of the CME CF BRR would not have the means to detect.

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