



CCCAGG Aggregate Index Validation

2021 December

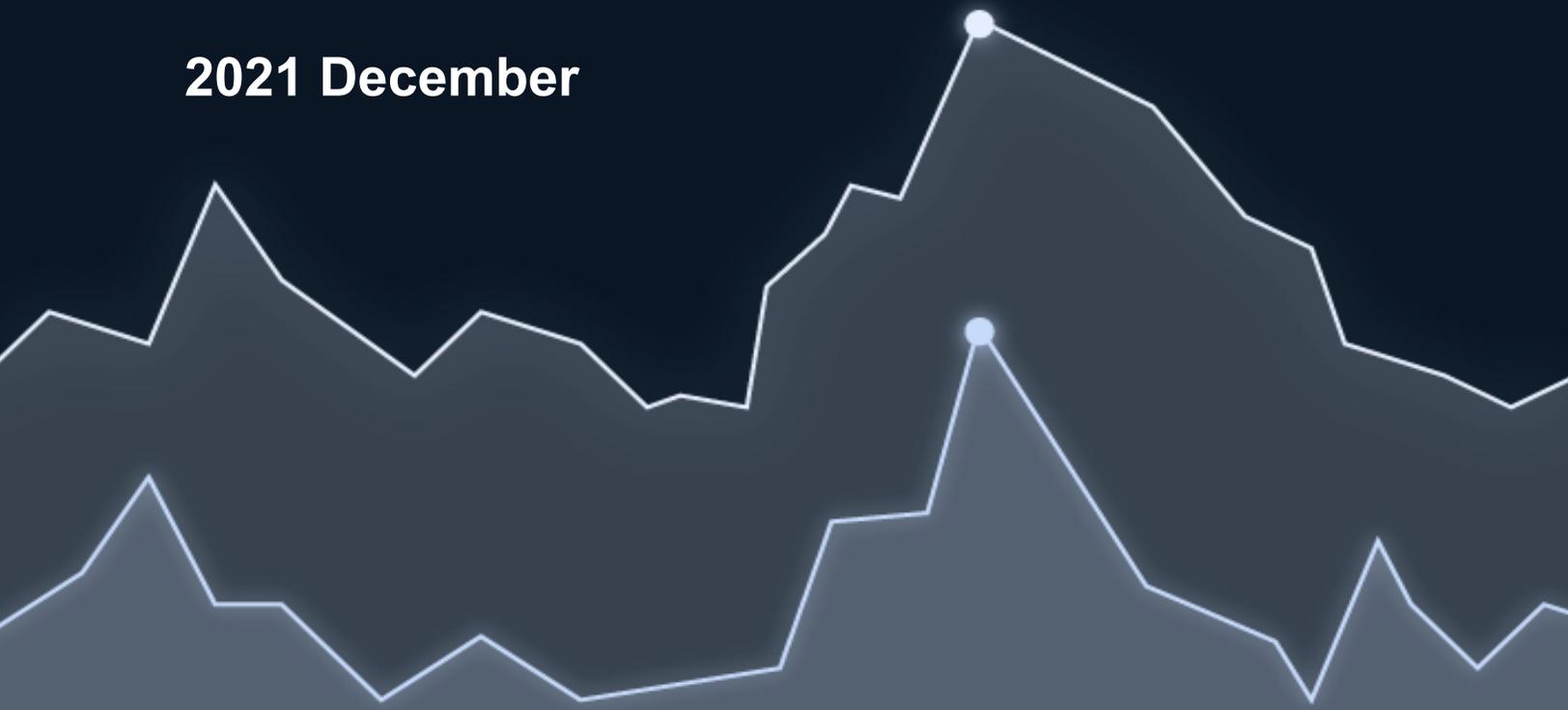


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Introduction

The Crypto Coin Comparison Aggregated Index (“CCCAGG”) refers to the real-time index calculation methodology, the purpose of which is to show the best price estimation for cryptocurrency traders and investors to value their portfolio at any time. CCCAGG is CryptoCompare's proprietary index calculation methodology for digital assets, based on 24-hour volume weighted average calculation, time-penalty factor and outlier methodology. It aggregates transaction data of more than 250 exchanges, using a 24 hour volume weighted average. The CCCAGG is calculated for each cryptocurrency in each market it is trading in (example: CCCAGG BTC-USD).

Find the full methodology here:

<https://data.cryptocompare.com/reports/cryptocompare-aggregate-index-methodology-jan-2021>

Goal of the Report

The goal of this report is to show that the CCCAGG index is representative and replicable by conducting a series of tests and benchmarking.

Thus this report is focused on the following key areas:

- CCCAGG methodology validation
 - Price consistency
 - Price stability
- Backtesting results
 - Recalculate daily CCCAGG values using raw trade data for the last 3 months
- Constituent exchange review
 - Summary of changes for this month's review
 - CCCAGG behaviour vs constituent exchanges behaviour

Executive Summary

In the December 2021 validation report, these are the main takeaways:

Price consistency

- For almost 90% of a total 732 pairs the daily CCCAGG price was less than 0.5% away from the median market price on average for the last 3 months, which is an indication of price consistency. This is very similar to the result from the November report.

Price stability

- When comparing the volatility of CCCAGG to the volatility of individual exchanges, 59% of the 732 pairs included in this test had a negative difference; meaning CCCAGG was less volatile than the average of the individual exchanges across the last 3 months. This is a decrease of 4 percentage points from the November report.
- Of the 41% that had a positive difference, 85% of the CCCAGG pairs were less than 1% more volatile than the individual exchange average.

Backtesting

- 99% of the 200 pairs where CCCAGG was replicated had less than a 0.5% average difference from the real time price over the 90 day period. This is the same as last month's report. Any differences may be a result of backfilled or late trades that were excluded from the real time calculation.

Constituent review

- On average, 2.46 billion USD in volume was added to CCCAGG per day through the review of constituent exchanges - a higher than normal amount due to the addition of exchanges across dry pairs. This caused a 0.73% change in the price on average for all pairs which received a change in exchange constituents.

Data

CCCAGG covers over 10,000 pairs, however, the majority of this validation report focuses on a subset of more liquid pairs, which are defined as the following:

- Have traded volume during the last 90 days
- Have more than 3 constituent exchanges

The methodology validation section of this report includes a total of 732 pairs for the December 2021 review.

Data used to create this report consists of:

- Historical daily, hourly and minute OHLC data for all exchanges and CCCAGG
- Raw trades from all exchanges

The full review result dataset is downloadable in CSV form upon request.

Methodology validation

CCCAGG methodology ensures that the index is robust to outliers. The following methodology features help achieve this goal:

- 24 hour volume weighting:
 - Ensures CCCAGG gives greater weight to liquid market prices, and price impact of illiquid (and therefore more volatile) markets is negligible.
- Time penalty factor
 - Ensures that exchanges that suspend trading or trade infrequently have an expiring price impact.
- Outlier Detection
 - Excludes trades that deviate significantly from the previous index price

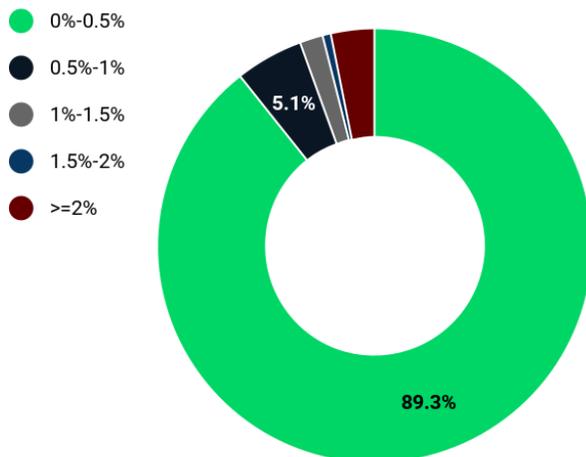
Thus, it is expected that:

- CCCAGG follows the market median price closely
- CCCAGG is less volatile than each individual exchange

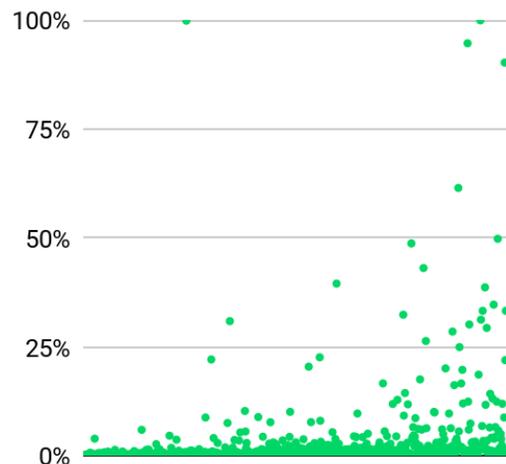
Price consistency

We measure price consistency by comparing daily CCCAGG values for the last 3 months with the median market price of the constituent exchanges. We are expecting the CCCAGG price to be close to the market median, but there may be bigger deviations for illiquid markets.

Average difference CCCAGG vs median - last 3 months
% of total pairs



Max difference for each pair - last 3 months



Left chart: Pie chart depicting the average difference between CCCAGG price and the median price of all constituent exchanges for the last 3 months. Right chart: Scatterplot depicting the maximum difference between CCCAGG price and the median price of all constituent exchanges over the last 3 months.

For just under 90% of a total of 732 pairs the daily CCCAGG price is less than 0.5% away from the median market price, on average over the last 3 months. The scatter plot shows pairs that have at least one day in the period with a much higher percentage difference - these are illiquid pairs where we prioritise price discovery and, thus, we allow more volatility.

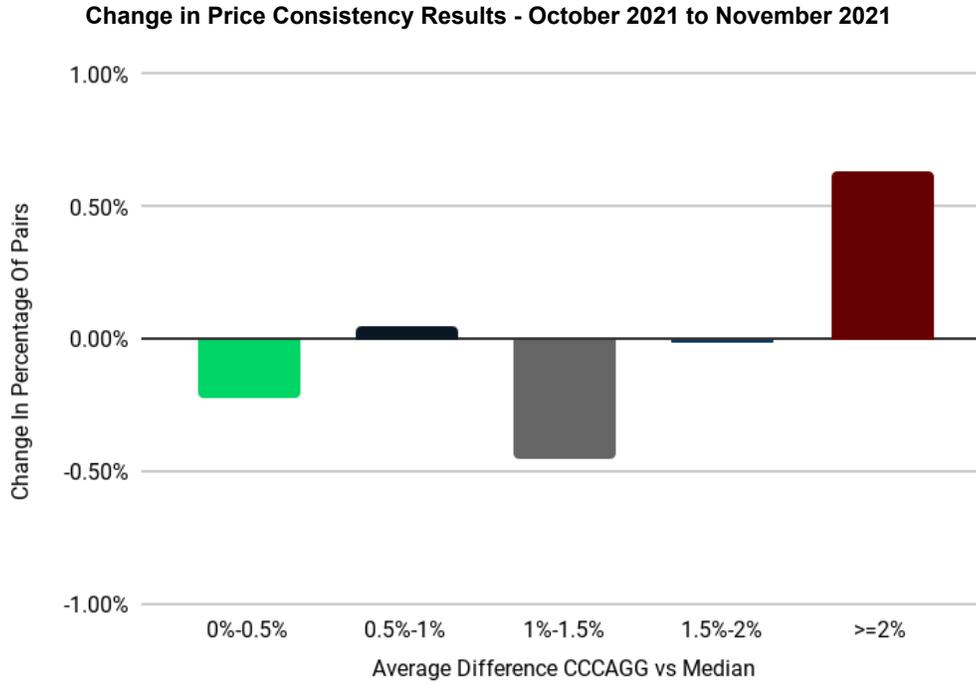


Chart showing the changes in the percentage of pairs that fall into each bracket of difference between CCCAGG price and the median market price, from the October 2021 to November 2021 report.

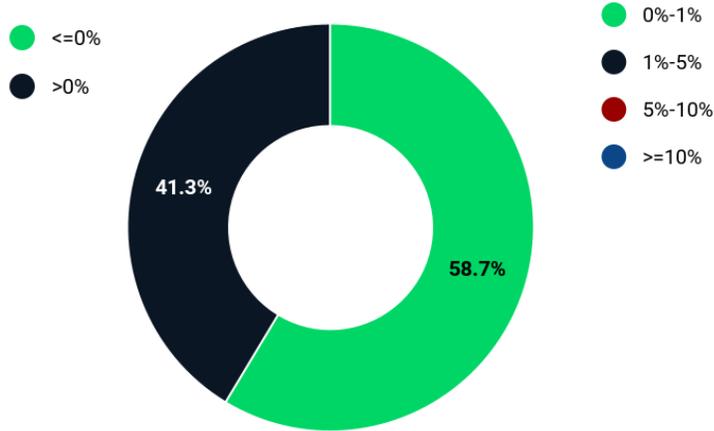
Compared to last month's report the number of CCCAGG pairs whose price was less than 0.5% away from the market median decreased very slightly.

Price stability

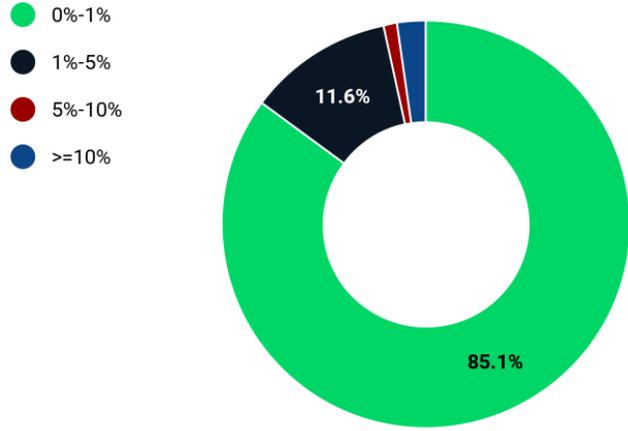
Price stability is measured by comparing daily CCCAGG volatility to market volatility in the last 3 months. In this report we measure volatility as the ratio of the high and low price during each day. We compare the CCCAGG volatility with the average market volatility across the past 3 months. A negative difference means CCCAGG is less volatile than the average of the individual exchanges in the market.

Average difference CCCAGG vs market volatility

% of total pairs



% of pairs with a positive difference



Left chart: Percentage of pairs that have either a positive or negative percentage difference between CCCAGG and market volatility. Right chart: Breakdown of the percentage difference of pairs which have a positive difference between CCCAGG and market volatility.

Of the 732 pairs included in this test, 59% had a negative difference, meaning CCCAGG was less volatile than the average of the individual exchanges across the last 3 months. Of the 41% that had a positive difference, 85% were less than 1% more volatile than the individual exchange average. This positive difference occurs generally on illiquid markets, where individual exchanges have infrequent updates, but combine to more frequent updates for the aggregate index.

Change in Price Stability Results - October 2021 to November 2021

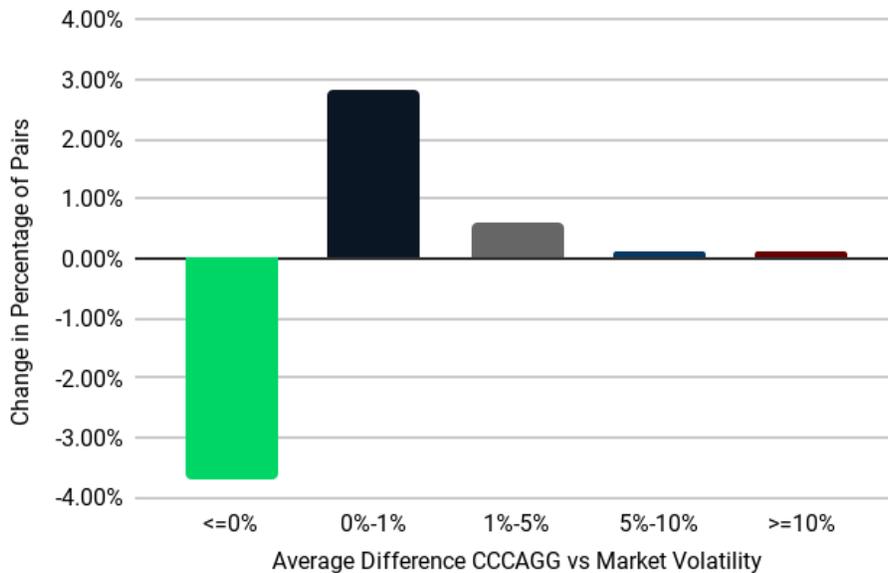


Chart showing the changes in the percentage of pairs that fall into each bracket of difference between CCCAGG volatility and the average market volatility, from the October 2021 to November 2021 report.

Compared to last month's report we saw a decrease of almost 4 percentage points in the number of pairs that have a negative difference, counter-acted by an increase in the percentage of pairs with a very small positive difference.

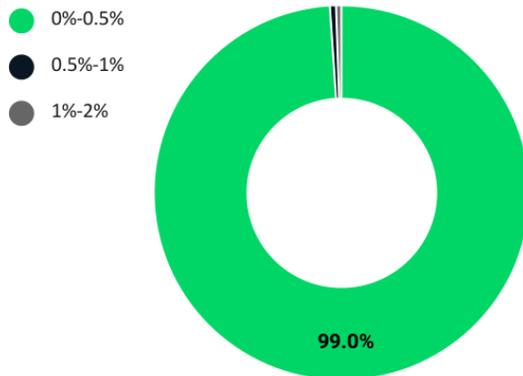
Backtesting results

CCCAGG should by nature be replicable as it is calculated from raw trade data. To demonstrate this the CCCAGG end of day value was re-calculated for the past 90 days, for the top 200 pairs by volume. This was done with an entirely separate script to the ones used to calculate CCCAGG in real time. The results from this were compared to the realtime CCCAGG calculation. Any differences might be due to:

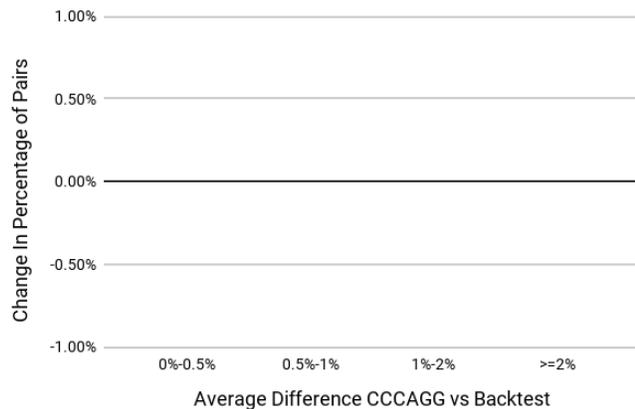
- Backfilled trades
- Late trades not taken into account
- Internal latency

Average difference - CCCAGG real time vs backtest

% of total pairs



Change from October 2021 to November 2021 report



Left Chart: average difference between CCCAGG real time values and backtesting for the top 200 pairs by volume.

Right Chart: change in the results from the previous to the current report.

99% of the 200 pairs had less than a 0.5% average difference over the 90 day period. One pair had a difference between 0.5 and 1% and another pair had a difference of between 1% and 2%.

Constituent exchange review

Each month the CCCAGG index constituents are reviewed, according to the Constituent Selection Criteria. Constituents are selected based on their Exchange Benchmark grade, trading volume and price stability. Read the full selection methodology under chapter 6 in the CCCAGG Index Methodology.

In the December review, a larger than usual number of exchanges have been added across a range of 'dry pairs'. Dry pairs are defined in the CCCAGG methodology as a pair with less than 4 total trading exchanges. The methodology states that all price feeds will be included in CCCAGG to aid price discovery for these pairs and the extra additions were made to reflect this. These additions to generally illiquid markets explain the higher than normal percentage volume change seen for December in the below table.

Volume and price impact of review

In this section, we compare CCCAGG aggregate volumes and prices after the review against CCCAGG aggregate volumes and prices before the review (all volumes in USD). To do this we:

- Compute the total difference for the last 30 days (net volume we add or remove after the review)
- Calculate the average volume change each day
- Calculate the average price change each day

After the December review, we added on average 2384 million USD a day in volume to CCCAGG.

Find the full list of removed and added constituents here:

<https://www.cryptocompare.com/media/39413389/cccagg-review-2021-december-results.pdf>

Values in millions of USD	September	October	November	December
Average volume added	184	359	128	2463
Average volume removed	(9)	(14)	(60)	(79)
Average change in volume	175	345	68	2384
% volume change	3.3%	0.97%	0.34%	91.6%

On average for all reviewed pairs that received a change in constituents, the CCCAGG prices changed 0.73% after the exchanges review. Across the top 20 pairs by volume that change is 0.27% on average.

Average difference CCCAGG price - last 30 days

% of pairs where a change in constituents occurred.

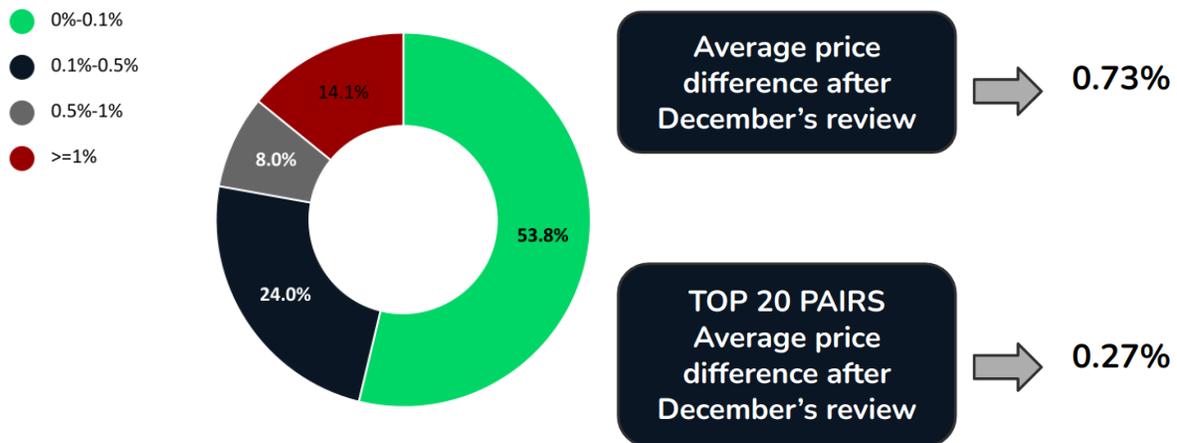


Chart depicting the average difference between CCCAGG price before the review and CCCAGG price after the review during the last 30 days.

CCCAGG Behaviour vs Constituent Exchange Behaviour

In this section, we chart the CCCAGG price vs constituent exchange prices for the top 5 pairs traded in USD across the last 30 days. The goal is to show how CCCAGG price is affected by any major price movements in any of the constituent exchanges during the time period. It is expected that CCCAGG is not significantly affected by unusual price changes in the constituent markets.

BTC - USD price - Last 30 days -Minute data

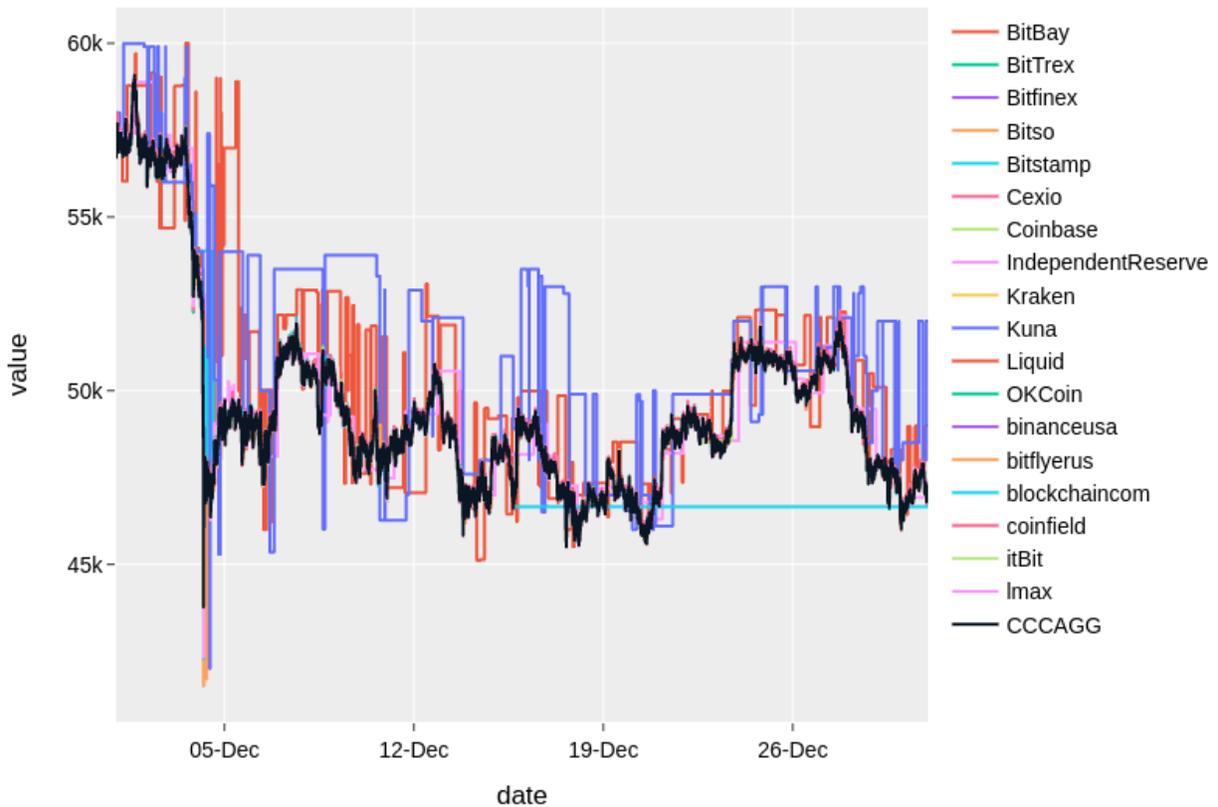


Chart depicting minute BTC-USD CCCAGG and constituent exchange prices for the last 30 days.

It is clear that particularly volatile prices, such as those occasionally on Kuna or Bitbay, do not impact the CCCAGG price. The stale price on blockchain.com towards the end of the period also has no impact on CCCAGG, due to the time penalty factor.

ETH - USD price - Last 30 days - Minute data

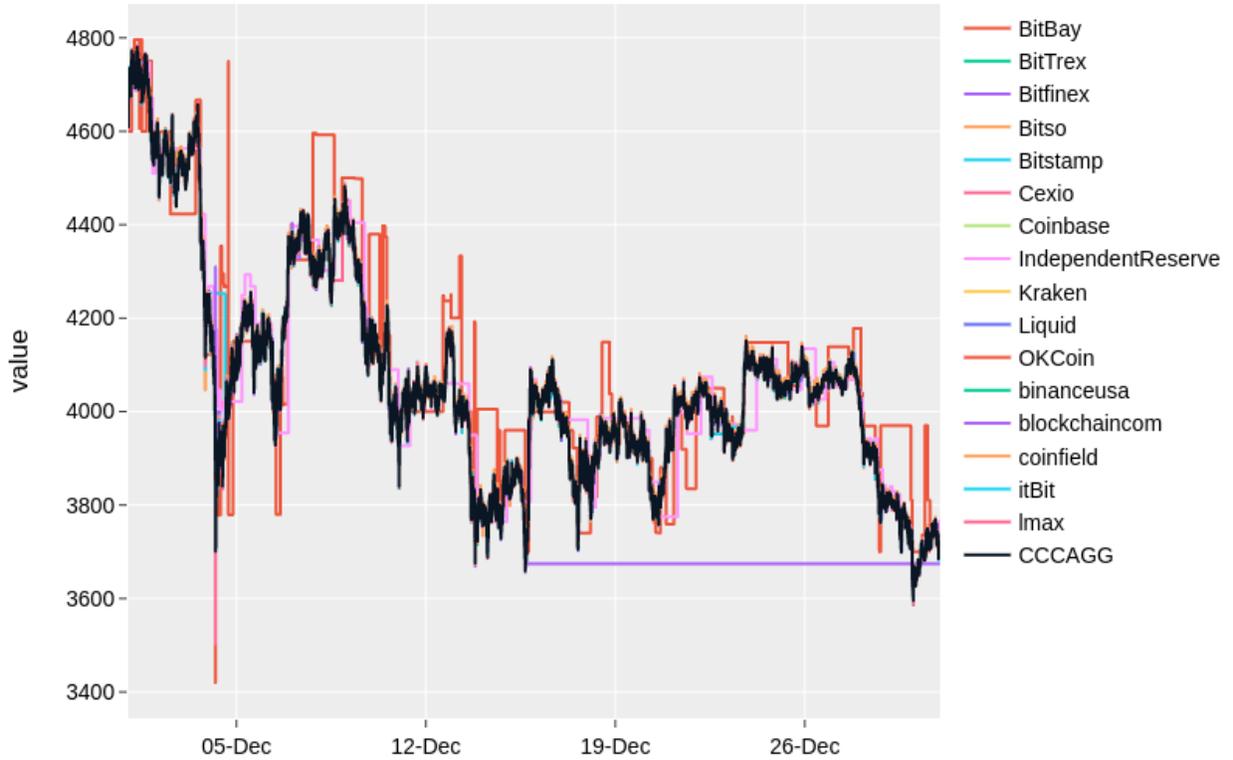


Chart depicting minute ETH-USD CCCAGG and constituent exchange prices for the last 30 days.

The CCAGG price follows the market and is not affected by the stale prices on blockchain.com towards the end of the period thanks to the time penalty factor, or by the erratic pricing on BitBay due to the 24hr volume weighting.

DOGE - USD price - Last 30 days - Minute data

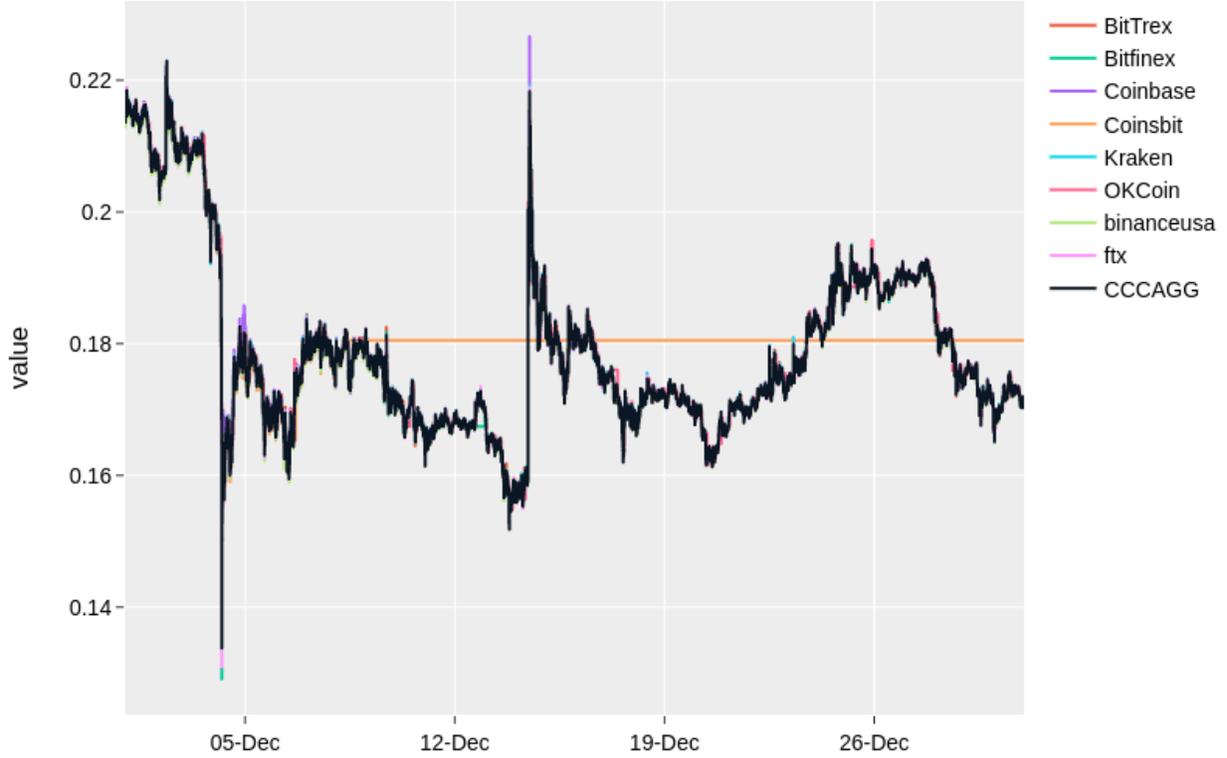


Chart depicting minute DOGE-USD CCCAGG and constituent exchange prices for the last 30 days.

The CCCAGG price tracks the market price well throughout the period, not being influenced by the stale pricing on Coinsbit.

XLM - USD price - Last 30 days - Minute data

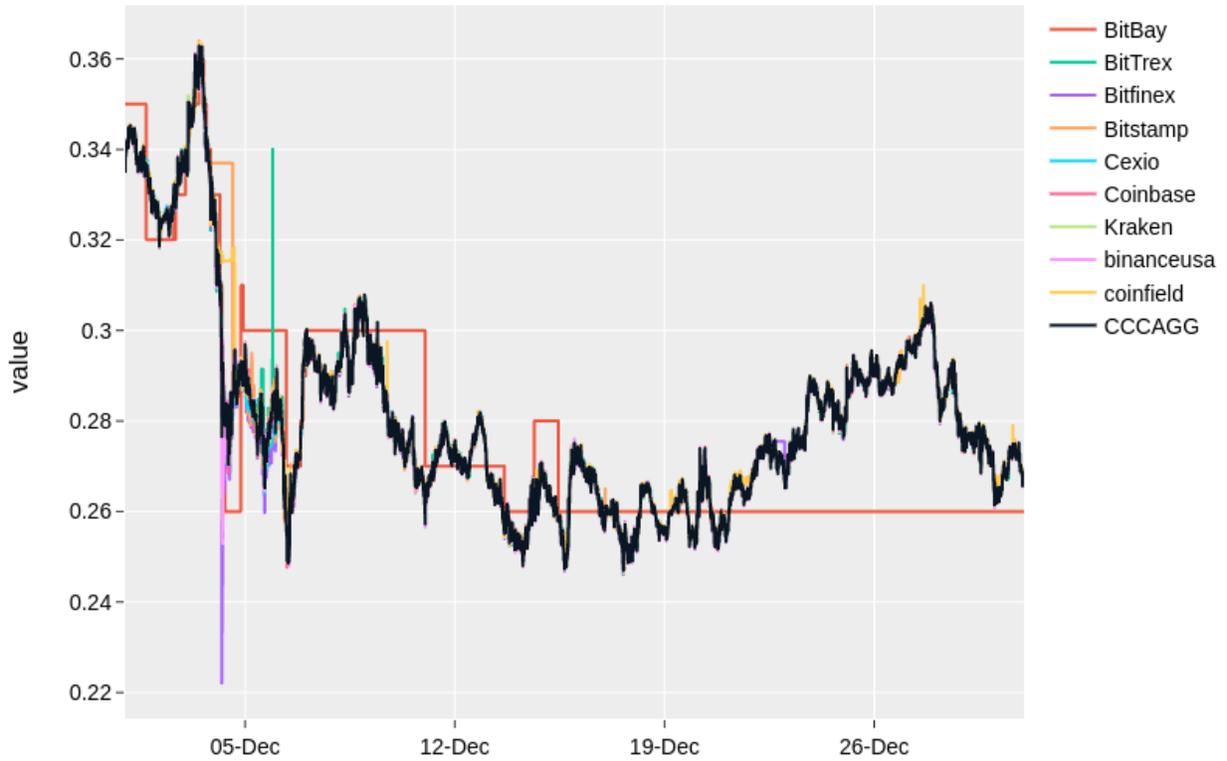


Chart depicting minute XLM-USD CCCAGG and constituent exchange prices for the last 30 days.

We see that the CCCAGG price tracks the market well, and is not affected by the occasional extreme peaks and troughs on BitTrex and Bitfinex, or by the stale prices on BitBay.

BCH - USD price - Last 30 days - Minute data

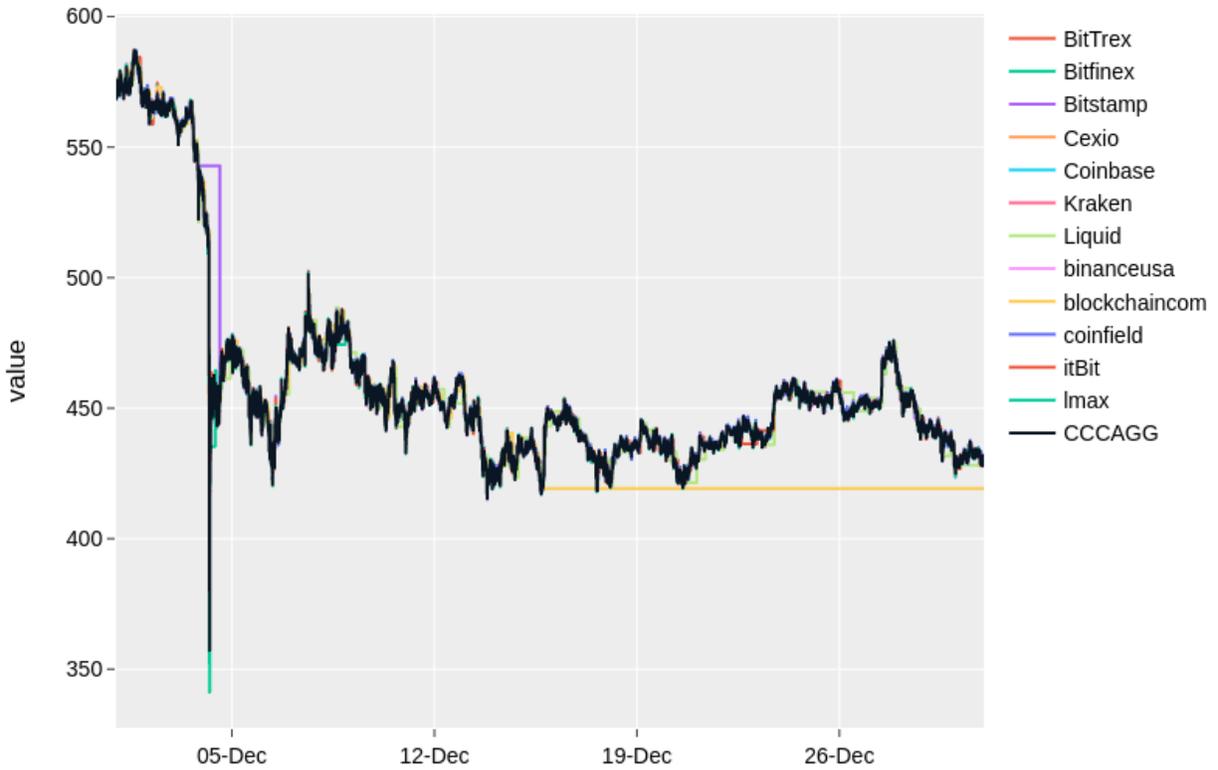


Chart depicting minute BCH-USD CCCAGG and constituent exchange prices for the last 30 days.

We can see that CCCAGG price tracks the market well, and is not impacted by the stale price on blockchain.com towards the end of the period.

Summary of top pairs

	Price consistency	Price stability	Backtesting
Pair	CCCAGG vs market median ⁽¹⁾	CCCAGG volatility vs average market volatility ⁽²⁾	Real time CCCAGG value vs Re-calculated CCCAGG value ⁽³⁾
	mean absolute difference	mean difference	mean absolute difference
BTC-USD	0.02%	-1.54%	0.01%
ETH-USD	0.03%	-0.27%	0.01%
USDT-USD	0.01%	-0.20%	0.02%
DOGE-USD	0.03%	-0.03%	0.01%
LTC-USD	0.04%	-0.21%	0.02%
XRP-USD	0.05%	0.08%	0.02%
LINK-USD	0.04%	0.78%	0.02%
XLM-USD	0.05%	-0.80%	0.02%
ADA-USD	0.03%	-0.29%	0.01%
ETC-USD	0.09%	-8.53%	0.04%

Notes:

(1) Daily difference calculated as: $(\text{CCCAGG Price} / \text{Median Exchange Price}) - 1$

(2) Volatility calculated as: $(\text{Daily high price} / \text{Daily low price}) - 1$

(3) Daily Difference % calculated as: $(\text{Real time CCCAGG value} / \text{Re-calculated CCCAGG value}) - 1$

Contact

If you are interested in using the CryptoCompare Aggregate Index (CCCAGG) in your products, please get in touch at data@cryptocompare.com.

Resources

CCCAGG Index Methodology

<https://data.cryptocompare.com/reports/cryptocompare-aggregate-index-methodology-jan-2021>

CryptoCompare Exchange Benchmark

<https://data.cryptocompare.com/reports/exchange-benchmark-august-2021>

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